

SINGLE STAGE EXPERIMENTAL EVALUATION
OF
SLOTTED ROTOR AND STATOR BLADING

PART III - DATA AND PERFORMANCE
FOR SLOTTED ROTOR 1

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ABSTRACT

A single-stage investigation of a slotted rotor was conducted as part of an overall program to evaluate the effect of slots on the performance of highly loaded compressor rotor and stator blade rows. The test rotor blades for this investigation were 65-series airfoils having a calculated unslotted tip D-factor loading of 0.465 and tip relative inlet Mach number of 0.772 at a radial station 10% of the span from the blade tip. For design equivalent rotor speed, the slotted rotor achieved a maximum adiabatic efficiency of 93.4% and a corresponding pressure ratio of 1.33.

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SECTION I
SUMMARY

A single-stage investigation of a slotted rotor was conducted as part of an overall program to evaluate the effect of slots on the performance of highly loaded compressor rotor and stator blade rows. The test rotor blades were 65-series airfoils and had a calculated unslotted blade D-factor loading of 0.465 and a rotor inlet relative Mach number of 0.772 at a radial station 10% of the span from the blade tip. The rotor blades were slotted at approximately 50% chord; the slots extended from 5 to 45% span from the tip, and from 50 to 90% span in each blade. The single-stage rig had a hub/tip ratio of 0.8, and the rotor tip diameter was about 40 in. The rotor blades had a constant chord length of 2.21 in., an aspect ratio of 1.71 and solidity of 1.15 at the mean radius. Design rotor tip velocity was 987 fps.

For design equivalent rotor speed, the slotted rotor achieved a maximum adiabatic efficiency of 93.4%, and a corresponding pressure ratio of 1.33. The measured D-factor values corresponding to maximum efficiency flow conditions were approximately 0.54 at the hub and tip and 0.47 at midspan. Measured deviation angles were essentially the same as the predicted unslotted blade deviation angles in the hub and tip regions and approximately 2 degrees lower than the predicted deviation angle at midspan. Measured loss coefficient was less than the predicted unslotted blade loss coefficient at 70 and 50% span locations, and was greater than the predicted loss at 30 and 10% span.

Comparison of the slotted rotor loss and D-factor loading characteristics for high incidence conditions with correlated NASA rotating cascade minimum loss incidence data indicates that the slot configuration for this investigation was effective in the achievement of loss levels equal to or less than those indicated by the NASA design curves for D-factor loading from 0.62 to 0.72.

SECTION II
INTRODUCTION

Pratt & Whitney Aircraft is engaged in a program under NASA Contract NAS3-7603 to investigate the application of slots to rotors and stators. A systematic investigation is being conducted to establish the feasibility and extent to which slotted blade concepts can be used to increase allowable blade loadings and the stable operating range of compressor stages. To accomplish this objective, three stator blade rows and three rotor blade rows have been built for test. Tests with stators use a representative state-of-the-art rotor to generate the stator inlet flow.

An aerodynamic analysis and design of the test blading and associated hardware were accomplished under the design phase of the program (Reference 1). All rotors and stators were designed with the same rotor exit and stator inlet absolute velocities and air angle distributions to permit testing of any combination of rotor and stator. It was assumed, for design purposes, that the flow deviation angle for slotted rotors and stators would be approximately one-half the values normally used for unslotted blades. As part of the design effort, a series of annular cascade tests with slotted stators was conducted to establish preliminary criteria for the design of slotted rotors and stators for the rotating stage test program (Reference 2).

This report presents the data and performance results obtained with the first slotted rotor configuration (Rotor 1). Rotor 1 blading was designed with 65-series airfoil sections and had calculated design tip values of D-factor loading and inlet relative Mach number (without slots) of 0.465 and 0.772, respectively. The rotor blades were slotted at approximately 50% chord; the slots extended from 5 to 45% span, and from 50 to 90% span in each blade. A set of inlet guide vanes was used to establish the whirl distribution into the test rotor. One of the test stator configurations, prior to slotting, was employed to remove some of the exit swirl. A set of exit guide vanes was used to remove the remainder of the exit swirl.

Overall performance and blade element data were obtained at 50, 70, 90, 100, and 110% of the design equivalent rotor speed. Blade element data were obtained at five radial locations behind each of the three blade rows, and rotating stall measurements were obtained at each of the five rotor speed conditions. Rotor wake surveys at five spanwise locations, using a hot-film anemometer, were obtained at choke, near-stall, and approximately maximum efficiency flow conditions at each rotor speed.

Details of the test equipment, procedures, and test results for the slotted Rotor 1 test configuration are presented in this report. Some design details are also included herein for convenience. Reference 1 gives further aerodynamic and mechanical design information.

SECTION III
TEST EQUIPMENT

A. FACILITY

The compressor test facility is shown schematically in figure III-1*. The compressor rotor is powered by a single-stage drive turbine using exhaust gases from a J75 slave engine. The drive turbine speed is regulated by a hydraulically actuated inlet flow control valve. The slave engine exhaust is also used to drive a two-stage exhaust-ejector system.

Air entered the compressor test rig through a 103-ft combined inlet duct, plenum, and bellmouth inlet, and exhausted through an exit diffuser to the atmosphere. A 7-deg diffuser in front of the inlet plenum ensured uniform flow conditions across the plenum, and an area contraction ratio from plenum to compressor inlet of approximately 10:1 provided essentially stagnation conditions in the plenum. The inlet duct and plenum were mounted on a track and could be rolled away from the compressor rig inlet to facilitate configuration changes. The plenum was sealed to the compressor rig inlet section with an inflatable rubber tube seal.

B. COMPRESSOR TEST RIG

The compressor rig, shown in figure III-2, comprises bellmouth inlet, test section, and exhaust section. The test section has a hub/tip ratio of 0.8 and a rotor tip diameter of approximately 40 in. The rotor assembly and shaft are supported on two bearings that transmit loads to the outer case through struts located in the inlet and exhaust case assemblies. The test section has a split outer case that permits guide vane, rotor, and stator assembly changes without removing the rig from the test stand. A set of motor-driven throttle vanes is located in the exhaust case to vary flow rate.

*All illustrations will be found in Section VII.

A section view of the flow path is shown in figure III-3. Flow is accelerated through the inlet strut station and guide vanes in a convergent passage to the rotor inlet. Thereafter, the inner wall diameter remains constant at 32.85 in. while the outer wall converges further through the rotor blade and stator vane rows to a diameter of 40 in. In general, the flow path is designed to simulate the middle-stage environment of a state-of-the-art multistage compressor.

Provisions were made for end wall bleed at the rotor tip and stator root and tip, as shown in figure III-4. Bleed air flowed through perforated plate shrouds, shroud manifolds, and 24 approximately equally spaced tubes to individual main collector manifolds for the rotor and stator. The collector manifolds exhausted through the facilities ejector system. Rotor and stator bleed flow rates were controlled and measured separately.

C. STAGE BLADING DESIGN

To expedite this research program, the aerodynamic and mechanical design of the blading was completed and fabrication initiated prior to completion of the annular cascade program. Final slot configurations were based on the results of the cascade tests.

1. Inlet Guide Vane

The inlet guide vanes were designed to provide a rotor prewhirl distribution of 22.8 deg at the root (90% span) to 24.4 deg at the tip (10% span). NACA series-400 blade sections were chosen for this purpose. Details of the guide vane design are presented in table III-1.

2. Rotor 1

a. Blade Design

Slotted Rotor 1 blading was designed with a camber distribution of 29.3 deg at the root (90% span) to 14.1 deg at the tip (10% span). NACA series-65 blade sections were selected for the rotor blades because this series airfoil has adequate thickness for slots, suitable loading distribution, and is capable of operating in the required Mach number range ($M_{tip} \approx 0.8$). It was assumed, for design purposes, that slots would reduce the flow deviation angle approximately one-half of the normal

Table III-1. Geometry Design Data

GUIDE VANE 1

Percent Span (From Tip)	κ_1	κ_2	ϕ	γ°	c	σ	t/c	δ°
90	0.000	32.65	-32.65	19.42	2.262	1.072	0.060	9.87
50	0.000	33.76	-33.76	20.07	2.262	0.981	0.060	11.02
10	0.000	38.11	-38.11	22.60	2.262	0.903	0.060	13.76

ROTOR 1

Percent Span (From Tip)	κ_1	κ_2	ϕ	γ°	i _m	0/0*	c	σ	t/c	δ°	$\bar{\omega}$
90	51.69	22.44	29.25	37.11	0.90	1.230	2.210	1.250	0.075	9.80	0.054
50	54.98	33.84	21.14	44.35	1.62	1.242	2.210	1.149	0.059	6.90	0.064
10	56.12	41.99	14.13	49.08	3.60	1.259	2.210	1.071	0.044	4.80	0.076

STATOR 1*

Percent Span (From Tip)	κ_1	κ_2	ϕ	γ°	i _m	0/0*	c	σ	t/c	δ°	$\bar{\omega}$
90	46.95	16.94	30.01	32.00	-1.68	1.187	2.182	1.192	0.090	10.14	0.040
50	46.95	16.94	30.01	32.00	-0.22	1.273	2.182	1.099	0.090	9.46	0.036
10	46.95	16.94	30.01	32.00	0.61	1.355	2.182	1.026	0.090	9.93	0.034

*Stator 1 metal angles have been altered from those in Reference 1 to reflect the actual installation.

values. Slotted rotor blade trailing edge metal angles were established in accordance with this assumption. Design D-factor loading at the rotor tip was 0.532 for the slotted blading and 0.455 for the same blading without slots (i.e., with full deviation), as reported in Reference 1.

Design performance for Rotor 1 without slots was recalculated to account for the fact that measured guide vane turning exceeded the design turning by approximately 5 degrees. The resulting tip D-factor and inlet relative Mach number design values were accordingly modified to 0.465 and 0.772, respectively, as reported herein.

Solidity, thickness ratios, and aspect ratios for the selected series airfoils were representative of the middle stage of a state-of-the-art compressor. Details of the rotor design are presented in table III-1.

b. Slot Design

Rotor 1 slot geometry and location were based on the results of preliminary annular cascade tests of slotted stator vanes and an analysis of Rotor 1 suction surface boundary layer separation (References 1 and 2).

The selected slot geometry was similar to a preferred slot geometry determined in the annular cascade program. Blade thickness at the intersection of slot centerline and blade meanline was selected as an approximate scaling parameter to scale the slot size from the oversize (6.5-in. chord) annular cascade vanes to the 2.21-in. chord Rotor 1 blading. The angle between slot centerline and blade meanline was held constant over the Rotor 1 blade span; i.e., the slot followed the twist of the blade. The slot spanwise position and geometry variables with corresponding dimensions at root, mean, and tip sections are presented in figure III-5.

The slot centerline intersected the blade suction surface at 50% chord, approximately halfway between the minimum pressure point and the calculated separation point. This slot location was determined under the annular cascade tests to be superior to an alternative location near the separation point.

The resulting slotted blade configuration is shown in figure III-6.

3. Stator

Three stators having unslotted root D-factor loading levels of 0.52, 0.60, and 0.70 were designed for evaluation of slotted stators under the contract program (Reference 1). The stators are 65-series airfoil sections. The stator having the lowest of the three loading levels (Stator 1, D = 0.52) was selected for use behind the slotted rotors. Even though this stator was unslotted, for these tests, it was considered to have an incidence range that would not limit slotted rotor evaluation. The selected stator had a constant equivalent circular arc camber of 30 deg and was untwisted. Because the annular cascade test results (Reference 2) indicated that slots did not produce the assumed decrease in deviation angle, the stator was installed behind slotted Rotor 1 with a blade chord angle of 32 deg instead of the original design blade chord angle of 37.2 deg. This blade chord angle was selected to ensure that stator minimum loss incidence would occur within the expected range of rotor exit angle. Additional details of the stator design are presented in table III-1.

D. INSTRUMENTATION

Instrumentation was provided for overall and blade element performance measurements for each blade row. Axial locations of instrumentation stations are indicated in figure III-3, and schematics showing the detailed instrumentation at each axial location are presented in figures III-7 through III-10.

1. Rig Inlet Conditions

Weight flow was measured with an ASME standard thin plate orifice located in the inlet duct.

Six static pressure taps and six temperature probes were located in the plenum chamber for measurement of inlet total pressure and temperature.

Six equally-spaced static pressure taps were located on both the inner and outer walls upstream of the inlet guide vanes (Station 0). From a rig calibration over a wide range of weight flows, a calibration between these static pressures was derived and used to check subsequent weight flow measurements.

2. Guide Vane Exit/Rotor Inlet; Station 1

A sectional view of the flow path at Station 1 showing the circumferential and radial location of instrumentation is presented in figure III-7. Rotor inlet air angle measurements were obtained at two circumferential locations with 20-deg wedge traverse probes. A 20-tube wake traverse probe, approximately aligned with the average guide vane exit air angle, was installed to measure guide vane wake total pressure distribution. Four static pressure taps were located on both the inner and outer wall. An 8-deg wedge traverse probe was used for measurement of radial static pressure distribution. Redundant static and mid-passage total pressure data were available from the 20-deg wedge probe.

3. Rotor Exit/Stator Inlet; Station 2

A sectional view of the flow path showing the circumferential and radial location of instrumentation at Station 2 is presented in figure III-8. Two 20-deg wedge traverse probes were used for air angle, total pressure, and total temperature measurements. Three sets of Kiel head total pressure probes were located at radial positions corresponding to 30, 50, 70, and 90% span, and two Kiel probes were located at 10% span. The probes were circumferentially located so that each set approximately averaged the pressures across a guide vane wake. Four static pressure taps were located on both the inner and outer wall. An 8-deg wedge traverse probe was used for radial static pressure measurement.

4. Stator Exit; Station 2A

A sectional view of the flow path showing circumferential and radial location of instrumentation at Station 2A is presented in figure III-9. Stator exit air angle was measured with a 20-deg wedge traverse probe. A 20-tube rake traverse probe was used for measurement of stator vane wake total pressure distribution. Four static pressure taps were located on both the inner and outer wall, and an 8-deg wedge traverse probe was provided for radial static pressure measurement.

5. Station 3

Station 3 is one chord-length farther from the stator exit plane than Station 2A. Instrumentation at this station (figure III-10) included

two 20-deg wedge traverse probes, one 8-deg wedge traverse probe, four sets of Kiel head total pressure probes at 10, 30, 50, 70, and 90% span location, four sets of Kiel head temperature probes at the same five span locations, and four static pressure taps on both the inner and outer wall. Stage exit total temperature was based on the Kiel head probe temperature measurements at Station 3. Data obtained from the other instrumentation at this station were generally used for comparison with the Station 2A data.

6. Description of Probes

Details of the 20-deg and 8-deg wedge probes, wake probe, and Kiel pressure and temperature probes are shown in figure III-11. The 20-deg wedge probe contained side pressure pickups for air angle measurement, a total pressure pickup and a total temperature pickup.

The wake probe contained 20 total pressure pickups formed by 0.042-inch OD hypo tubing and spaced as shown in the figure.

7. Instrumentation Readout

Traverse probe data (total pressure, static pressure, air angle, total temperature, and radial travel) were recorded on magnetic tape at the rate of 60 samples (2.5-in. probe travel) per minute. Steady-state pressure measurements were obtained using a Scannivalve multichannel pressure transducer system that includes automatic data recording on IBM cards. Kiel probe temperatures were indicated on a precision potentiometer, and manually recorded.

Plenum pressures, three OD static pressures at Station 0, primary and bleed system flow-measuring-orifice pressures, and three Station 3 midspan Kiel probe pressures were recorded on manometer tubes in the test stand control room to permit setting the desired flow conditions.

8. Special Instrumentation

a. Rotating Stall Instrumentation

Three Kistler (601A) pressure transducers were installed at Station 2 for rotating stall measurement (figure III-8). Transducer output was recorded on a CEC VR-2800 tape recorder.

b. Rotor Wake Instrumentation

Rotor wake surveys were obtained with DISA 55479 hot-film anemometer probe, located as shown in figure III-8. Anemometer output voltage was recorded on a VR-2800 tape recorder. The hot-film probe is shown in figure III-12.

c. Rotor Exit Boundary Layer Instrumentation

Rotor exit endwall boundary layer total pressure profiles were measured to set bleed flow rates using a three-hole cylindrical yaw probe having a 3/4-in. tip (dimension between sensing ports and probe tip) and a diameter of 3/8 in. Total pressure and radial travel were recorded on an x-y plotter.

d. Rotor Speed

Rotor rpm was measured with an electromagnetic pickup mounted adjacent to a 60-tooth gear on the rotor shaft. Gear tooth passing frequency was displayed as rpm on an Anadex digital readout system. A closed loop control system maintained rotor speed within approximately $\pm 1\%$.

e. Stress Measurements

Five rotor blades and five stator vanes were instrumented with strain gages to monitor and record torsional and bending stresses. Strain gage locations on a typical instrumented rotor blade are shown in figure III-13.

f. Vibration

Displacement pickups were mounted on forward and rear sections of the compressor rig outer case to monitor rig vibration.

g. Bleed Flow Rate

Bleed flow rates from the rotor and stator were measured by means of standard ASME thin plate orifices located in the respective bleed manifold exit pipes.

SECTION IV
PROCEDURES

A. TEST PROCEDURE

1. End Wall Bleed Flow Rate Selection

a. Rotor Bleed

With the compressor operating at design speed and flow conditions, the three-hole yaw probe was traversed between 0 and 20% span at Station 2 behind the rotor for each of three bleed flow settings. The three settings corresponded to near-zero, half of maximum, and maximum bleed flow rates. The bleed flow rate selected was that which produced the most significant improvement in total pressure profile as indicated on the x-y plotter. The valve setting for this bleed flow rate was not changed at other rotor speed and flow conditions.

b. Stator Bleed

With the rotor end wall bleed set at the selected rate, the procedure described above was repeated for the stator. The 20-tube wake probe was positioned at 10 and 90% span locations, and the effect of boundary layer bleed on the stator wake pressures was monitored on manometers. The valve setting corresponding to the bleed flow rate that produced the most significant improvement at either span location at design speed and flow conditions was selected for the test program.

2. Stress Survey and Rotating Stall Tests

A stress survey program was conducted to define the stress and vibration characteristics of the slotted rotor over the operating range and in the stall regions. Blade stresses were monitored and recorded along the choke line, along an assumed operating line, and into the stall region at the five rotor speed conditions. Fixed instrumentation was recorded at a sufficient number of speed and flow conditions to define the overall operating range between choke and stall and between 50 and 110% design speed.

Kistler transducer data were recorded during the excursions into stall along each speed line to define rotating stall patterns.

3. Overall and Blade Element Performance Tests

Overall and blade element performance data were obtained at five rotor speed conditions (50, 70, 90, 100, and 110% of design speed) and at approximately six points per speed line to adequately define rotor and stage performance between choke and stall. The near-stall test point was determined on the basis of strain gage output and stage exit total pressures indicated on manometers. At each speed and flow set point, the fixed pressure and temperature instrumentation data were recorded five times, corresponding to five discrete radial locations of the inlet guide vane and stator vane wake probes. Traverse data were usually recorded during the last recording of fixed instrumentation. In this manner, representative average values of flow and pressures could be determined for the time period (approximately 45 min) of data recording at each point.

4. Rotor Wake Surveys

Rotor wake surveys were obtained following the recording of blade element and overall performance data at choke, approximately maximum efficiency, and near-stall conditions on each of the five speed lines. Hot-film anemometer output was recorded as the probe was traversed from the inner to the outer wall behind the rotor.

B. DATA REDUCTION PROCEDURES

1. Preliminary Data Reduction

Data reduction was accomplished in three steps using three computer programs. The first step involved conversion of raw data to engineering units. Traverse data (total pressure, static pressure, total temperature, and air angle), obtained at approximately 0.04-in. increments across the span, were automatically plotted (as well as tabulated). The plotted and tabulated data were reviewed to identify and eliminate any obviously questionable data prior to the subsequent data reduction step.

The second data reduction step accomplished the following:

1. Mach number corrections to temperature data
2. Mass average of wake probe data
3. Circumferential arithmetic average of fixed and traverse instrumentation data
4. Correction of all pressure and temperature data to NASA standard day ambient conditions
5. Selection by interpolation of total and static pressure, total temperature, and air angle values at specified radial locations for input for the final data reduction step.

All corrected data were available for further inspection in the printed results from this computer program, which included individual data values as well as averaged quantities. The third step in the data reduction procedure involved calculation of overall and blade element performance parameters, which are defined in the following paragraphs.

2. Parameter Calculation

The following overall and blade element performance parameters were calculated for the analysis of test data and the evaluation of slotted Rotor 1 performance. Symbols are defined in Appendix A.

a. Overall Performance

(1) Weight Flow

Weight flow is presented in terms of corrected weight flow, defined as:

$$\frac{W\sqrt{\theta}}{\delta}$$

where:

W = actual weight flow

θ = ratio of total temperature (plenum) to NASA standard sea level temperature

δ = ratio of total pressure (plenum) to NASA standard sea level pressure.

Values of corrected weight flow presented in the figures and tables include rotor and stator bleed flow rates. Percentage bleed flow rates for the respective blade rows are tabulated separately (table B-1).

(2) Pressure Ratio

Pressure ratios were calculated for the rotor, guide vane-rotor, and guide vane-rotor-stator blade row combinations. Behind the rotor, fixed Kiel head and traverse probe total pressure data were arithmetically averaged at each span location and the profile thus defined was mass-flow averaged across the span.

Behind the guide vane and stator, the wake probe pressures were first mass-flow integrated at each span location, and the resulting average pressures were then mass-flow averaged in the radial direction.

(3) Adiabatic Efficiency

Adiabatic efficiency across the rotor is defined as

$$\eta_{ad} = \frac{\left(\frac{\bar{P}_2}{\bar{P}_1}\right)^{\frac{\gamma-1}{\gamma}} - 1}{\frac{\bar{T}_3}{T_1} - 1}$$

where:

- \bar{P}_1 = mass averaged pressure behind the guide vane
- $T_1 \equiv 518.7^{\circ}\text{R}$
- \bar{P}_2 = mass averaged pressure behind the rotor
- \bar{T}_3 = mass averaged temperature behind the stator.

To obtain adiabatic efficiencies for the guide-vane-rotor combination or for the entire stage, appropriate average pressures were used.

b. Blade Element Performance

(1) Diffusion Factor

Diffusion factor for the rotor is defined as

$$D = 1 - \frac{V'_2}{V'_1} + \frac{\Delta V'_{\theta(1-2)}}{2\sigma V'_1}$$

Diffusion factor for the stator is defined as

$$D = 1 - \frac{V_{2A}}{V_2} + \frac{\Delta V_{\theta(2-2A)}}{2\sigma V_2}$$

(2) Deviation Angle

Rotor blade deviation is defined as

$$\delta_2^\circ = \beta_2' - \kappa_2'$$

Stator deviation is defined as

$$\delta_{2A}^\circ = \beta_{2A} - \kappa_{2A}$$

where κ_2' and κ_{2A} are the rotor blade and stator vane trailing edge metal angles based on equivalent circular arc camber lines for the 65-series airfoil.

(3) Incidence Angle

Rotor incidence is defined as

$$i_{m1} = \beta_1' - \kappa_1'$$

Stator incidence is defined as

$$i_{m2} = \beta_2 - \kappa_2$$

where κ_1' and κ_2 are the rotor blade and stator vane leading edge metal angles based on equivalent circular arc camber lines for the 65-series airfoil.

(4) Total Pressure Loss Coefficient

Total pressure loss coefficient for the rotor is defined as

$$\bar{\omega}_{(1-2)}' = \frac{\bar{P}_1' - P_2'}{\bar{P}_1' - P_1}$$

For the inlet guide vanes, total pressure loss coefficient is defined as

$$\bar{\omega}_{(0-1)} = \frac{14.69 - \bar{P}_1}{q_o}$$

where q_o is obtained from isentropic flow relationships using orifice weight flow and the annular area at the guide vane inlet, and $(-)$ refers to mass averaged wake total pressures.

Total pressure loss coefficient for the stator is defined as

$$\bar{\omega}_{(2-2A)} = \frac{P_2 - \bar{P}_{2A}}{P_2 - p_2}$$

(5) Loss Parameter

Rotor total pressure loss is also presented in terms of the loss parameter,

$$\bar{\omega}'_{(1-2)} = \frac{\cos \beta'_2}{2\sigma}$$

SECTION V
RESULTS AND DISCUSSION

Slotted Rotor 1 performance was evaluated on the basis of pressure rise and efficiency characteristics as functions of rotative speed and weight flow, as well as blade element diffusion factor, deviation, and loss coefficient as functions of incidence angle. Slotted rotor performance results are compared with (1) predicted unslotted rotor performance and (2) available NASA rotating cascade performance results. A brief description of guide vane and stator performance is included in this section. Overall and blade element experimental performance parameters and bleed flows and blade element vector diagram data for the guide vane, rotor, and stator are tabulated in Appendix B. The results of stress surveys, rotating stall measurements and rotor wake surveys are included under the discussion of rotor performance.

A. OVERALL PERFORMANCE

Overall performance is presented in terms of efficiency and pressure ratio versus corrected weight flow, $W\sqrt{\theta}/\delta$, and corrected specific weight flow, $W\sqrt{\theta}/\delta A$, in figures V-1, V-2, and V-3, for rotor, guide vane-rotor, and guide vane-rotor-stator combinations. Each figure contains the performance results obtained at the five test rotor speed conditions. Values of corrected airflow obtained from integration of flow profiles downstream of the rotor and stator are compared with the main orifice measured values minus bleed flow in figure V-4. The figure shows that general agreement was obtained within $\pm 7\%$.

As reported in Reference 1, the design efficiency and pressure ratio for Rotor 1 are given as 89% and 1.31 respectively without slots (normal deviation angles) and 91% and 1.37 respectively with slots (reduced deviation angles) at a design flow of 96 lb/sec. Because measured guide vane turning angle exceeded the design angle by 5 degrees (as discussed under paragraph B1), the performance was recalculated on the basis of the actual turning angle, resulting in essentially the same design levels of efficiency and pressure ratio, but at a reduced design flow rate of 90 lb/sec. The three sets of values of predicted performance thus defined are included in figure V-1 for comparison with the slotted rotor test results. Hereinafter, design performance calculated for normal

deviation (unslotted blades) and the actual guide vane turning angle will be used in comparisons with the data. As expected, with the increased guide vane turning, the rotor operated at slightly decreased flow rates for equivalent pressure ratios. A maximum efficiency of 93.4% and a corresponding pressure ratio of 1.33 were achieved at approximately the revised design flow rate of 90 lb/sec (predicted on the basis of the actual guide vane air turning angle). The measured pressure ratio is slightly higher than predicted for normal deviation angle and revised inlet guide vane turning. This is partially due to the higher than estimated efficiency and partially because deviation angles were slightly less than normal as discussed in paragraph B.

The guide-vane-rotor performance characteristics in figure V-2 indicate that guide vane total pressure loss had a negligible effect when compared with rotor performance in figure V-1. The stage performance (guide-vane-rotor-stator) in figure V-3 indicates a significant effect of stator loss on stage efficiency and pressure ratio when compared with the guide-vane-rotor performance in figure V-2. The maximum efficiency was decreased from about 93 to 80% and the pressure ratio corresponding to maximum efficiency decreased from 1.33 to 1.28.

B. BLADE ELEMENT PERFORMANCE

1. Inlet Guide Vane

Inlet guide vane exit air angle distributions are presented in figure V-5 for the design speed line test data. Air angle data obtained with each of the two 20-deg wedge probes are identified by symbol, and the design air angle distribution is shown for comparison. Note that the average measured air angle is about 5 deg greater than the design air angle, which resulted in approximately 4-deg lower than design incidence on the rotor at the original design flow conditions of 96 lb/sec. The guide vane overturning was attributed to an over-conservative design approach to achieve the desired relatively high turning with the 400-series airfoil section.

Inlet guide vane vector diagram and blade element data are included in table B-2.

2. Rotor

a. Rotor Inlet Conditions

Rotor inlet relative Mach number and air angle radial distributions for the design speed data points are presented in figure V-6. Calculated design point distributions are shown for comparison. The design Mach number distribution is in good agreement with the measured distributions shown for choke and stall conditions.

At the weight flow corresponding to maximum efficiency ($W\sqrt{\theta}/\delta = 90.9 \text{ lb/sec}$), the inlet relative air angle distribution is within 1 or 2 degrees of the design distribution. Design incidence angles would be attained at a flow of about 93 lb/sec.

b. Loss Coefficient; Deviation Angle; D-Factor

Slotted Rotor 1 blade element performance data obtained at design equivalent rotor speed are presented in terms of loss coefficient, deviation, and D-factor versus incidence in figures V-7 through V-11. Each figure corresponds to one spanwise location. Calculated design values of loss coefficient, deviation, and D-factor are shown in the figures for comparison with the data. The slotted rotor D-factor loading values are approximately the same as the design values at 30, 50, and 70% span locations and slightly higher than design values at the hub and tip (90 and 10% span) as indicated in the figures. Slotted rotor deviation angles are approximately the same as the design values in the hub and tip regions and slightly less (1 to 3 deg) than the design values in the midspan region (30, 50, and 70% span). Loss coefficients for the slotted rotor are about the same or lower than the design values at 50, 70, and 90% span. In the blade tip region (10 and 30% span) the slotted rotor loss coefficient is higher than predicted.

The apparent difference in deviation and loss coefficient between the predicted and measured values at midspan is similar to the difference observed between unslotted and slotted stator performance in the annular cascade program (Reference 2).

Blade element parameters for the five speed lines are combined in figures V-12 through V-16 to show the general consistency of the data. The deviation and D-factor parameters form a fairly well defined curve with incidence at each of the five span locations. Rotor tip inlet relative

Mach number varied between about 0.3 and 0.9 over the rotor speed and flow range. A slight effect of Mach number on D-factor, deviation, and loss coefficient is apparent from inspection of the symbols in figures V-12 through V-16 that correspond to the 50 and 110% design rotor speed data. It can be seen that D-factor, deviation, and loss coefficient for 110% design rotor speed are generally slightly higher than the corresponding values for 50% design rotor speed. Also, the 110% design rotor speed loss coefficient data exhibits a narrower incidence angle range characteristic than that formed by the data corresponding to 50% design rotor speed.

c. Loss Parameter

Loss parameter, $\bar{\omega}'_{1-2} \cos \beta'_2 / 2\sigma$, is presented as a function of D-factor in figures V-17a, b, and c for the blade element data obtained at 70 and 50% span, 90 and 30% span, and 10% span, respectively. Data corresponding to 90, 100, and 110% design rotor speed are included in each part of the figure. NASA correlation curves (reproduced from Reference 3) for NASA 65-series and circular arc series rotating cascade minimum loss (reference incidence), data are shown for comparison.

In general, the minimum loss data appear to be consistent with the respective NASA correlation curves for minimum-loss data. The 70 and 50% span data that correspond to incidence angles greater than minimum loss incidence indicate D-factor loading level values up to 0.52 at loss parameter levels that are equivalent to the NASA minimum-loss correlation curves. Tip data (10% span) that correspond to incidence angles greater than minimum loss incidence indicate D-factors as high as 0.68 at loss parameter levels below the NASA curve. Although the 90 and 30% span data are above the NASA correlation curve that includes data for these span locations, they extend the loading level range to better than $D = 0.6$ without a sharp rise in loss. This indicates that the present slot design and location are more effective at high incidence angles than at design incidence.

d. Stress Survey Results

A brief stress survey program was performed with slotted Rotor 1 to define the bending and torsion stress characteristics over the planned operating range. Transient recordings of strain gages, mounted on the blades as shown in figure III-13, were obtained at each rotor speed condition as the throttle vanes were actuated to reduce flow rate.

The resulting stress values at various locations on the compressor map are presented in figure V-18. Bending stress levels were on the order of 5000 psi along the choke line and the major portions of the constant speed lines. Stall stresses ranged from 12,500 psi at 50% design speed to 31,600 psi at 110% design speed.

First bending and torsion vibration frequencies at design rotor speed were 480 to 500 cps and 1200 to 1280 cps, respectively, which are in good agreement with calculated values given in Reference 1.

e. Rotating Stall Results

Rotating stall measurements were obtained with three Kistler pressure transducers during the stress survey program as the stall region was approached along each speed line. A typical recording of rotating stall is presented in figure V-19. Rotating stall at each speed condition was characterized by a single stall zone that covered half the annulus and rotated at approximately 20% of the rotor speed. Rotor stall was abrupt at all test rotor speeds except the 50% design speed condition. A more gradual stall characteristic was observed at this speed.

f. Rotor Wake Survey Results

Rotor wake surveys were obtained at three flow conditions along each speed line: choke, approximately maximum efficiency, and near-stall. A hot-film anemometer probe (figure III-12) was traversed behind the rotor from the inner to the outer wall to obtain blade wake definition at several span locations. A sample of the anemometer output on either side of each desired radial location was displayed on an oscilloscope such that from 10 to 15 consecutive wake traces for an isolated blade were superimposed. The oscilloscope display thus established is presented in figures V-20 through V-24. Major scale division of these figures represent 1/2-in. in the horizontal direction and 30 ft/sec in the vertical direction.

The blade wakes are generally not well defined in the root region (90% span) at all rotor speed conditions. For the 90 and 100% design rotor speed conditions, the wake sizes at 70, 50, and 30% span locations appear to decrease from the choke point to near-maximum efficiency condition, with little apparent growth at the near-stall condition. Of interest

at the 90% rotor speed condition is the development of an apparent vortex at 70% span at near-stall conditions. The vortex is characterized by an intermediate wake between the blade wakes. This secondary velocity deficiency is more pronounced at the 100% design speed condition, and extends out to 50% span. The unpredictable and apparently random appearance of this intermediate wake may be associated with inlet guide vane wakes passing through the rotor, as suggested in Reference 4.

3. Stator

Stator inlet Mach number and air angle distribution for design speed data are presented in figure V-25. Calculated design values of these two parameters shown for comparison are seen to be within the range of test data. The stator was operating closest to its design inlet air angle at a weight flow of about 95.2 lb/sec at midspan. As stall conditions were approached, the stator inlet air angle distribution breaks sharply upward in the end wall regions, resulting in a positive incidence of approximately 10 degrees at the 90 and 10% span sections for the stall point.

Stator vector diagrams and blade element data are included in table B-2 for general information. Analysis of these data and subsequent unslotted Stator 1 data as it is pertinent to the overall objectives of the program will be included in the final report on this program.

SECTION VI
CONCLUDING DISCUSSION

Blade element data at five radial locations and overall performance data were obtained for a slotted rotor configuration at several flow conditions, including choke and near-stall, along five rotor speed lines between (and including) 50 and 110% of the design speed. Measured rotor pressure ratio and efficiency were slightly higher than the calculated design values for normal deviation angles. Maximum slotted rotor efficiency was 93.4% compared with a design efficiency of 90%, and the slotted rotor pressure ratio corresponding to maximum efficiency was 1.33 compared with a design value of 1.295. Maximum efficiency and corresponding pressure ratio were obtained at the calculated design weight flow of 90.2 lb/sec. Stator losses resulted in a stage maximum efficiency of only 80%, and a stage pressure ratio of 1.28.

In general, slotted Rotor 1 achieved the design blade element performance levels calculated for normal deviation angles at design incidence. The D-factor loading at hub and tip were slightly greater than predicted, and the deviation angles in the midspan region were 1 to 3 degrees less than predicted. The measured loss coefficient was about the same as the calculated design value in the root region (90% span), lower than design value in the midspan region (50 and 70% span), and greater than the design value in the tip region (30 and 10% span). The latter result may be attributed to inability of the slot flow in the tip region to overcome a radial flow shift toward the root. It is possible that the slot location in the tip region is too far rearward for maximum effectiveness. Also, it is considered that the slot should extend all the way to the rotor tip for greater effectiveness.

Although the loading level of the slotted rotor was equal to the predicted loading level at design incidence, higher loading levels were achieved at higher incidence angles with corresponding measured loss coefficients equal to the predicted design incidence loss coefficient.

SECTION VII
ILLUSTRATIONS

This section contains the illustrations that have been referenced
in the preceding sections.

FD 10891B

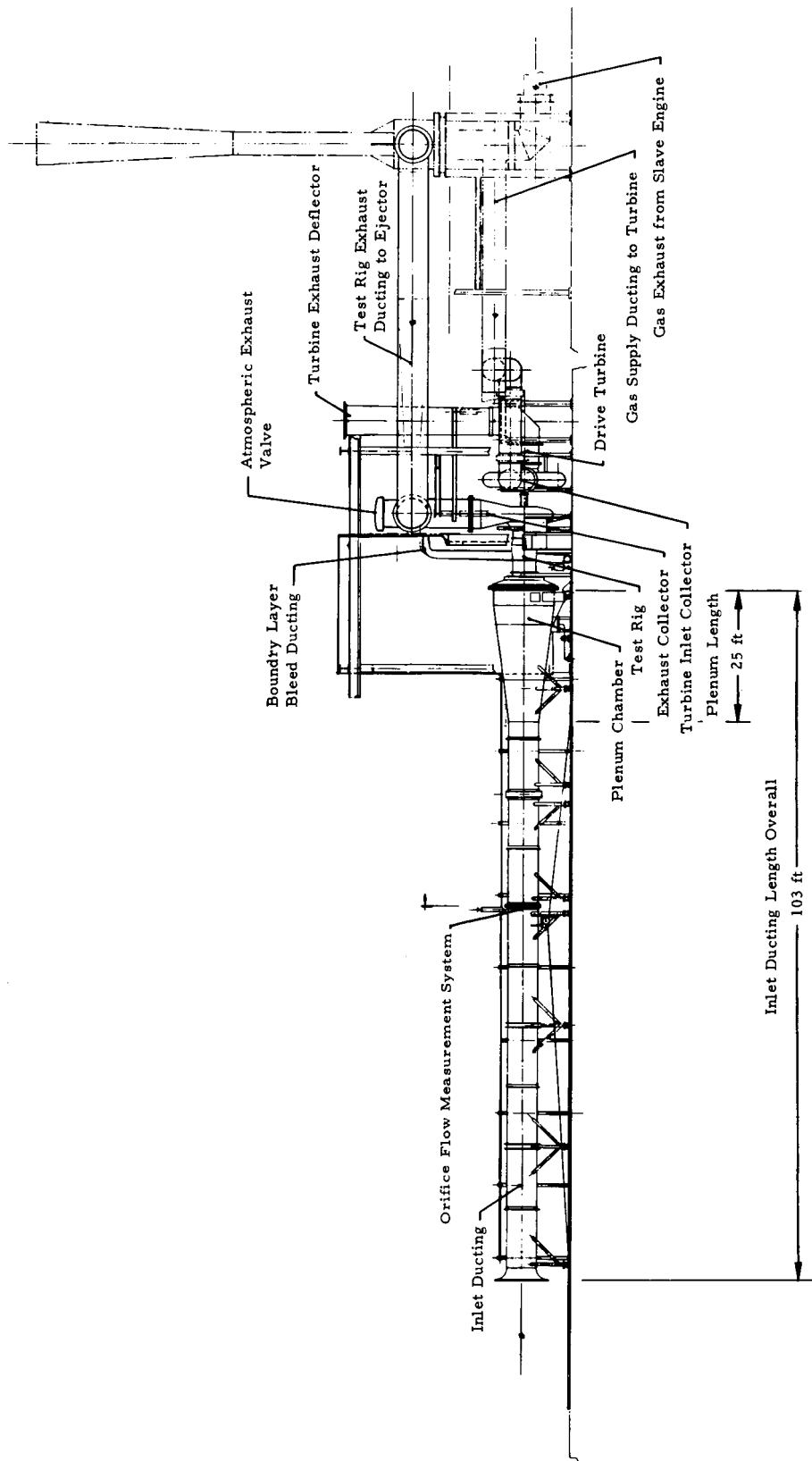


Figure III-1. Compressor Research Facility

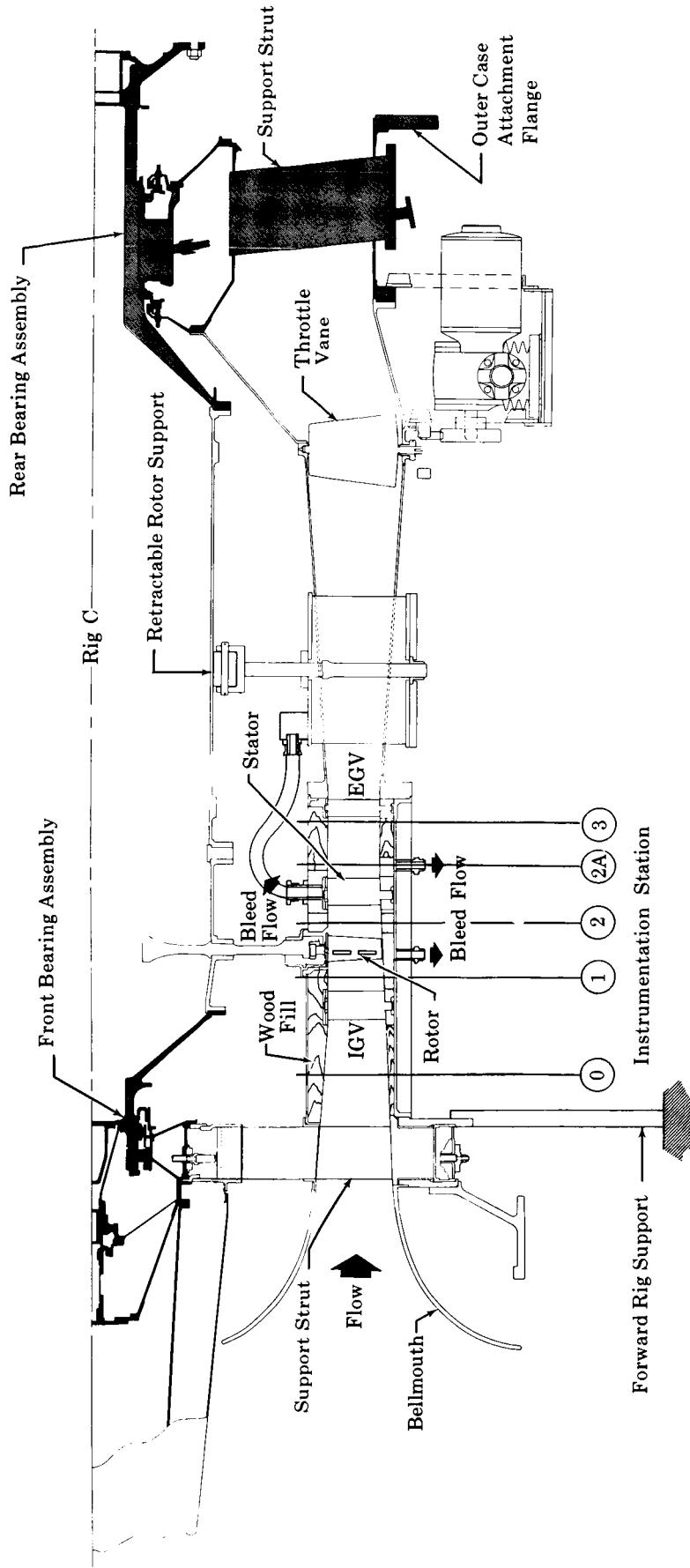


Figure III-2. Rotating Axial Flow Cascade Test Rig

FD 14681A

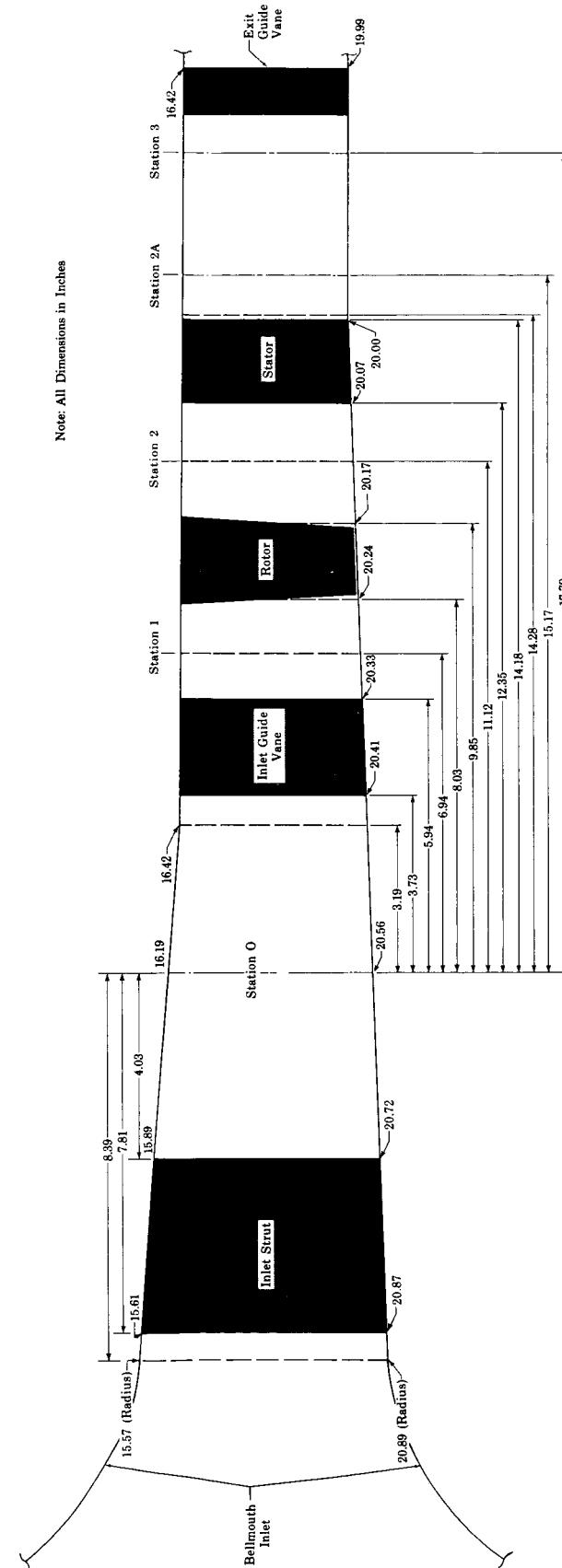


Figure III-3. Flow Path

Rig G

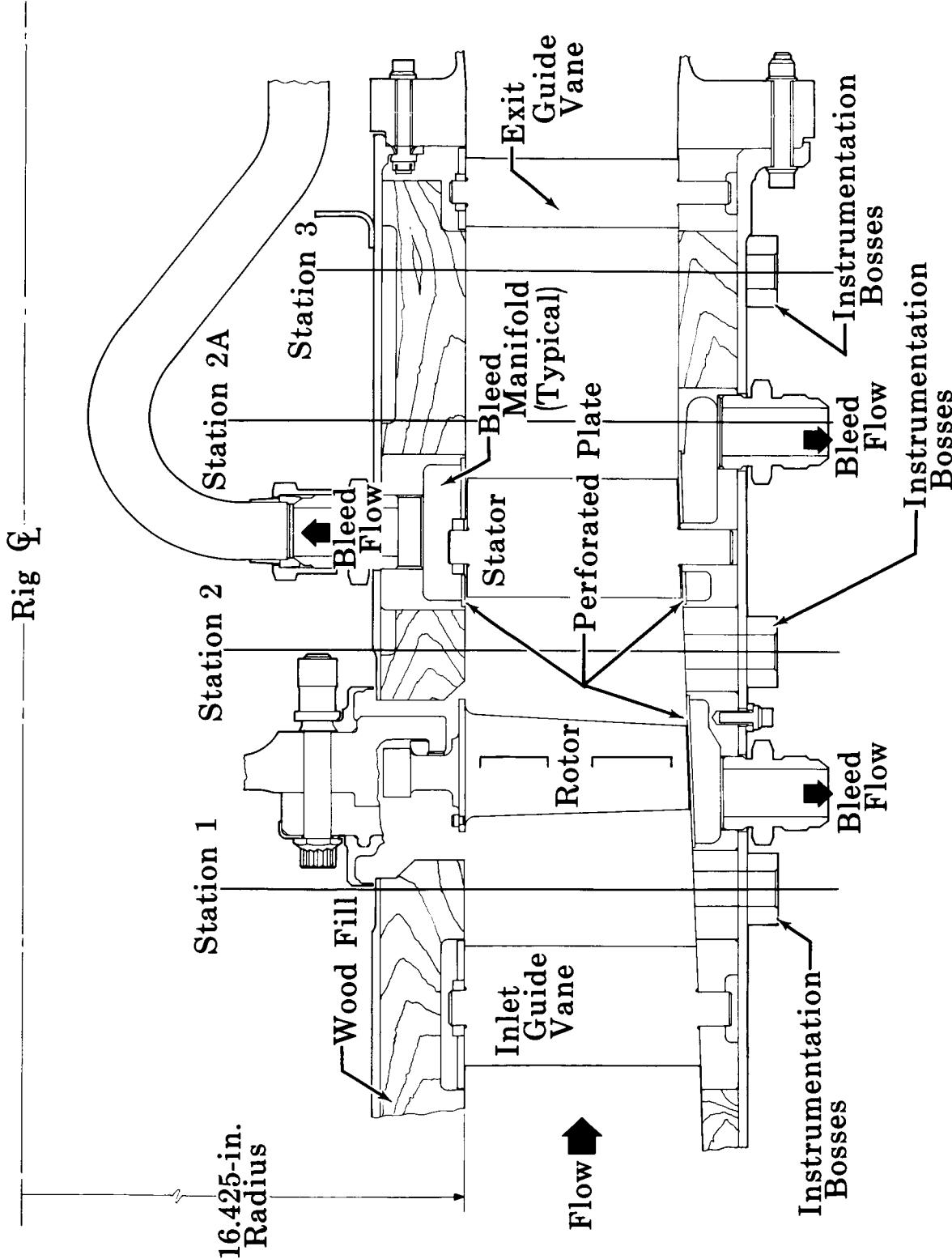


Figure III-4. Rotating Cascade Rig Bleed System

FD 14683A

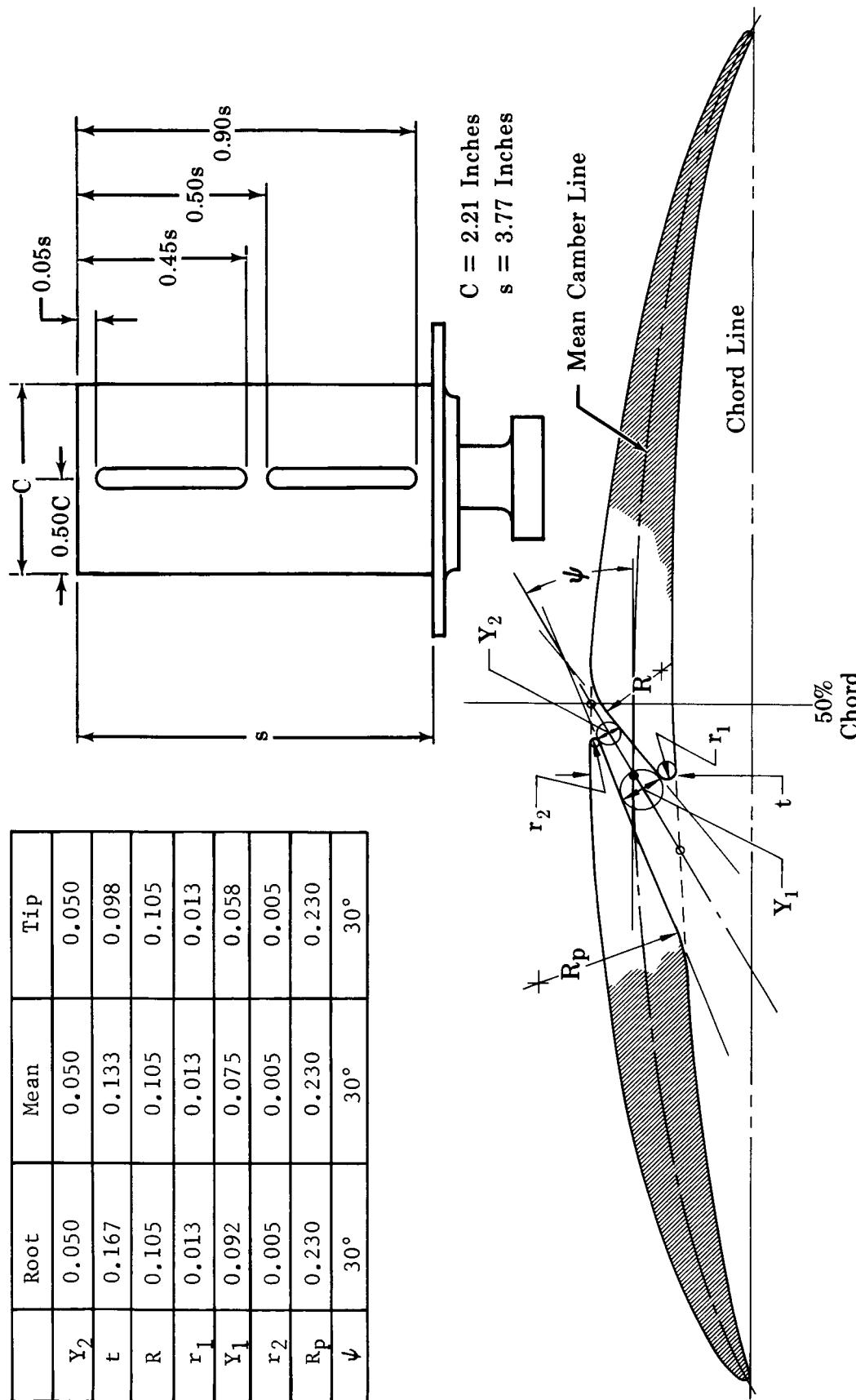
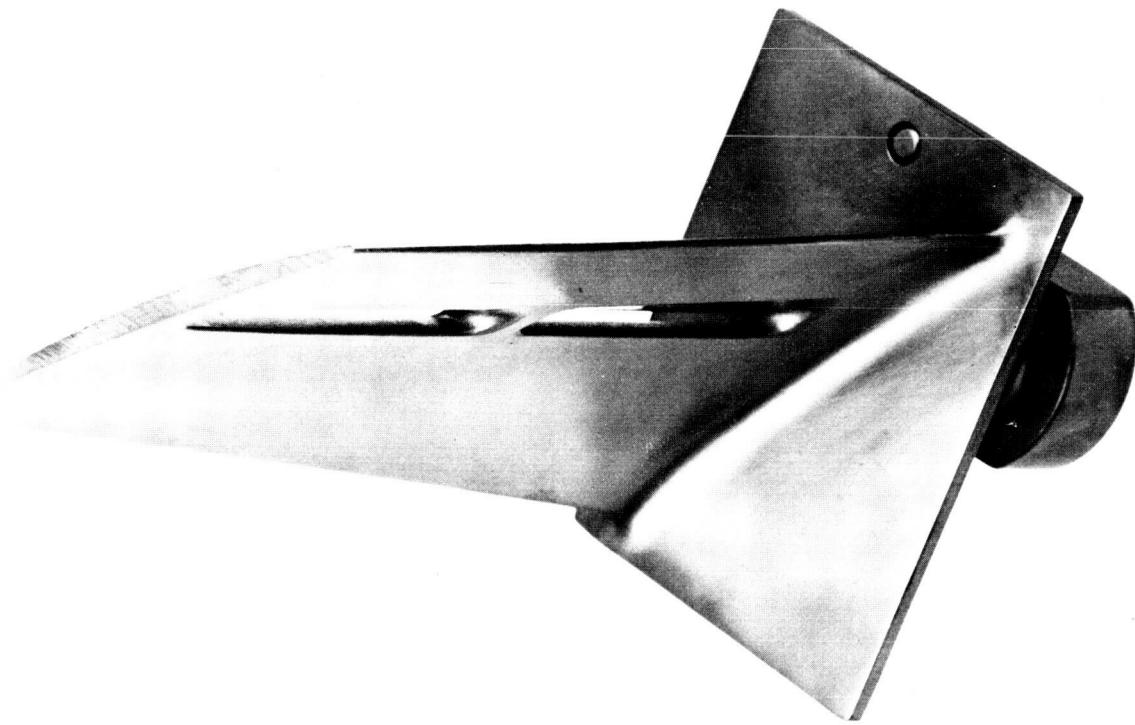


Figure III-5. Slot Geometry and Location

FD 14679D

FD 18462A

PRESSURE SURFACE



SUCTION SURFACE

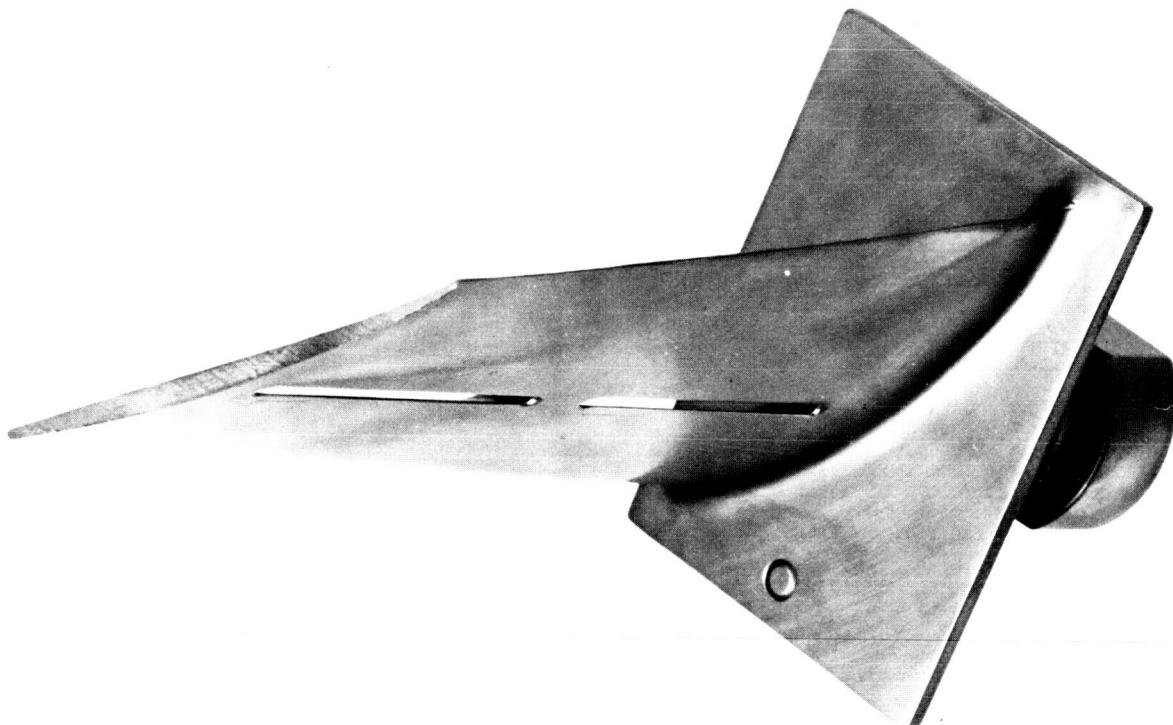
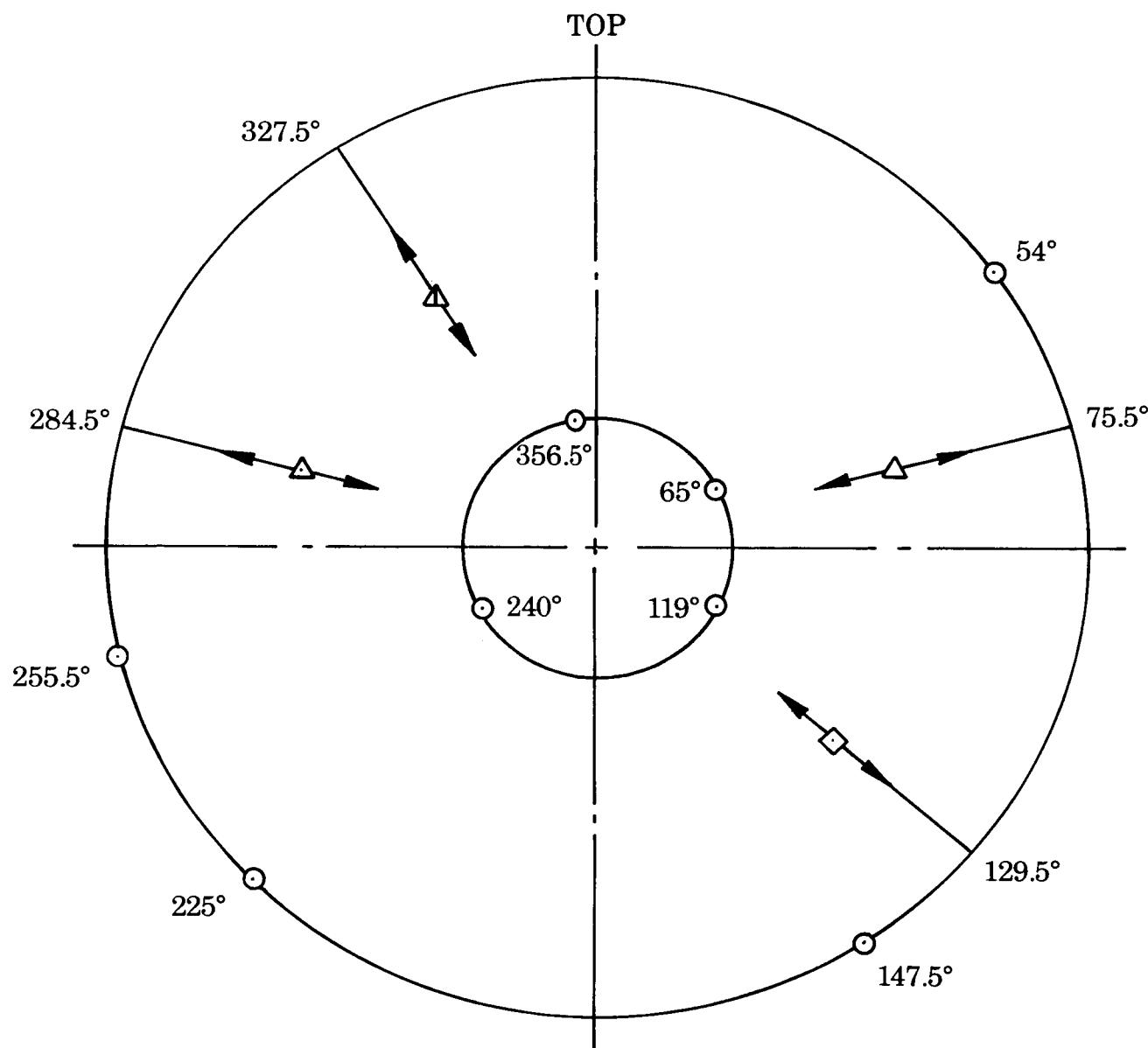


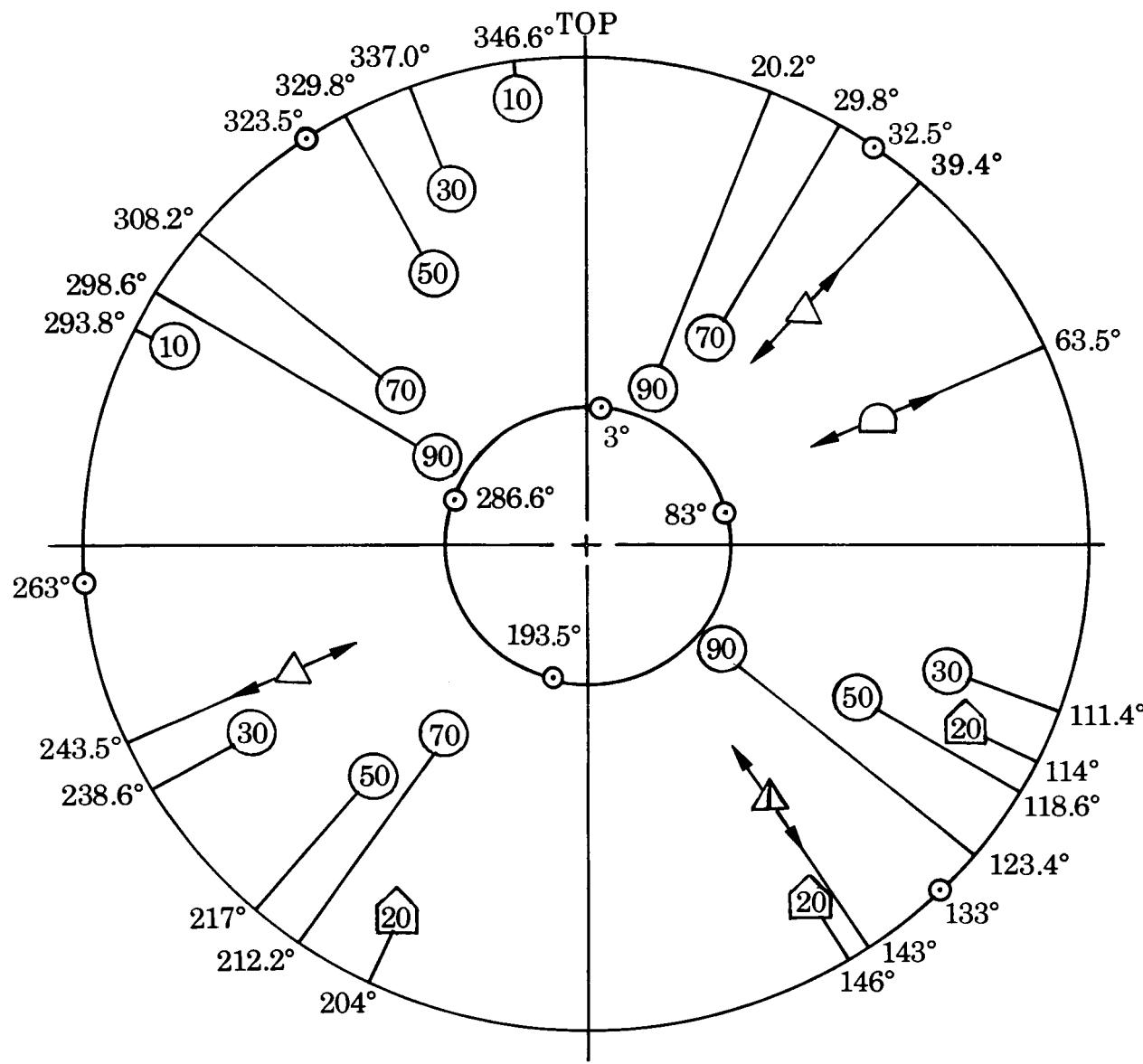
Figure III-6. Typical Slotted Rotor 1 Blade



- Wall Static Pressure
 - △ Traverse Wedge Probe, 20°
 - △ Traverse Wedge Probe, 8°
 - ◇ Traverse Wake Probe
- Probe angular position is measured clockwise from the top.

Figure III-7. Instrumentation, Station 1 (View
Looking Downstream)

FD 18596B

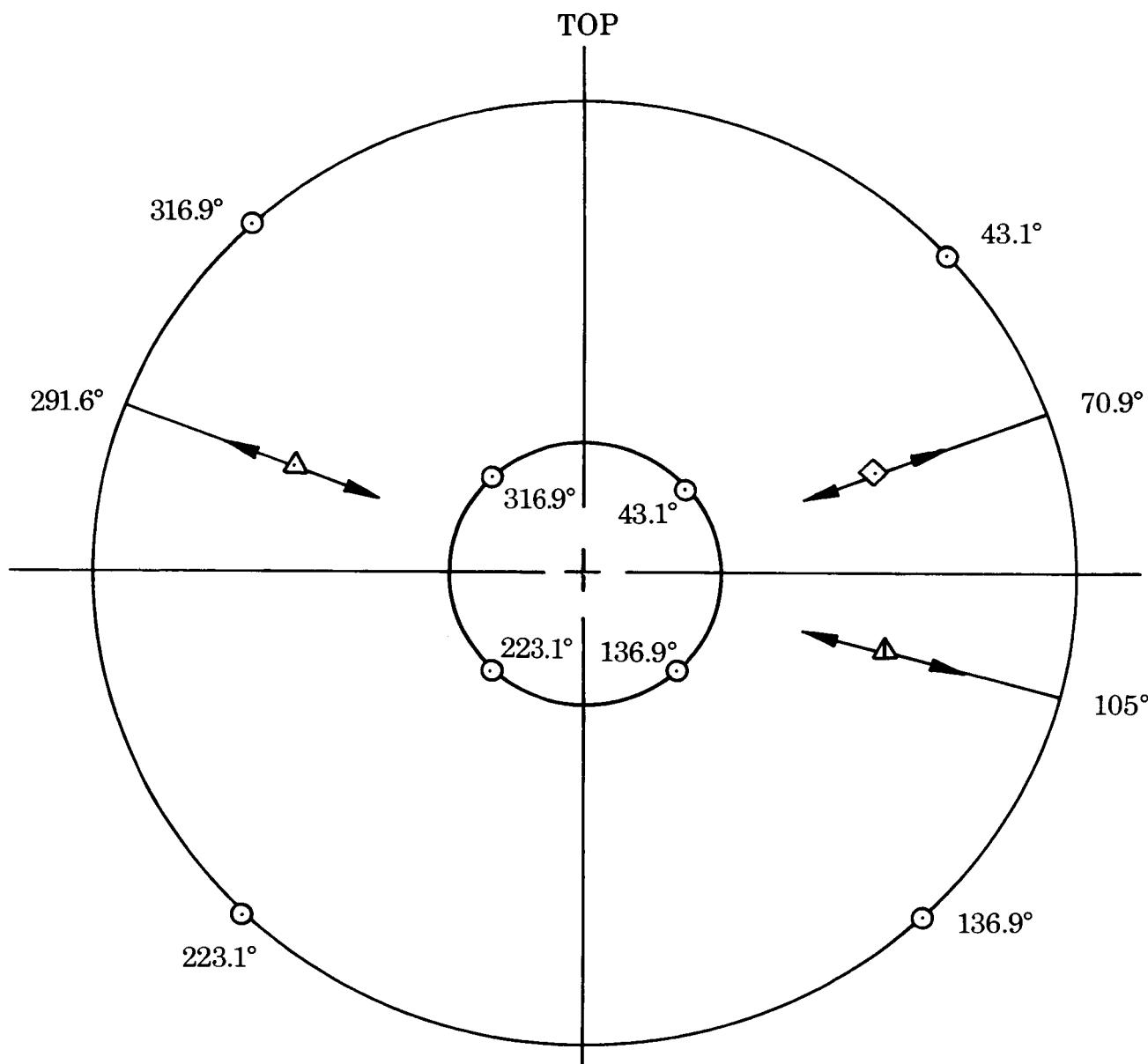


- Kiel Probe *
- Wall Static Pressure
- △ Traverse Wedge Probe, 20°
- △ Traverse Wedge Probe, 8°
- Traverse Hot Film Probe
- ◇ Kistler Probe *

Probe angular position is measured clockwise from the top.
*Radial location as a percent of span from tip is denoted by the number within the symbol

Figure III-8. Instrumentation, Station 2 (View Looking Downstream)

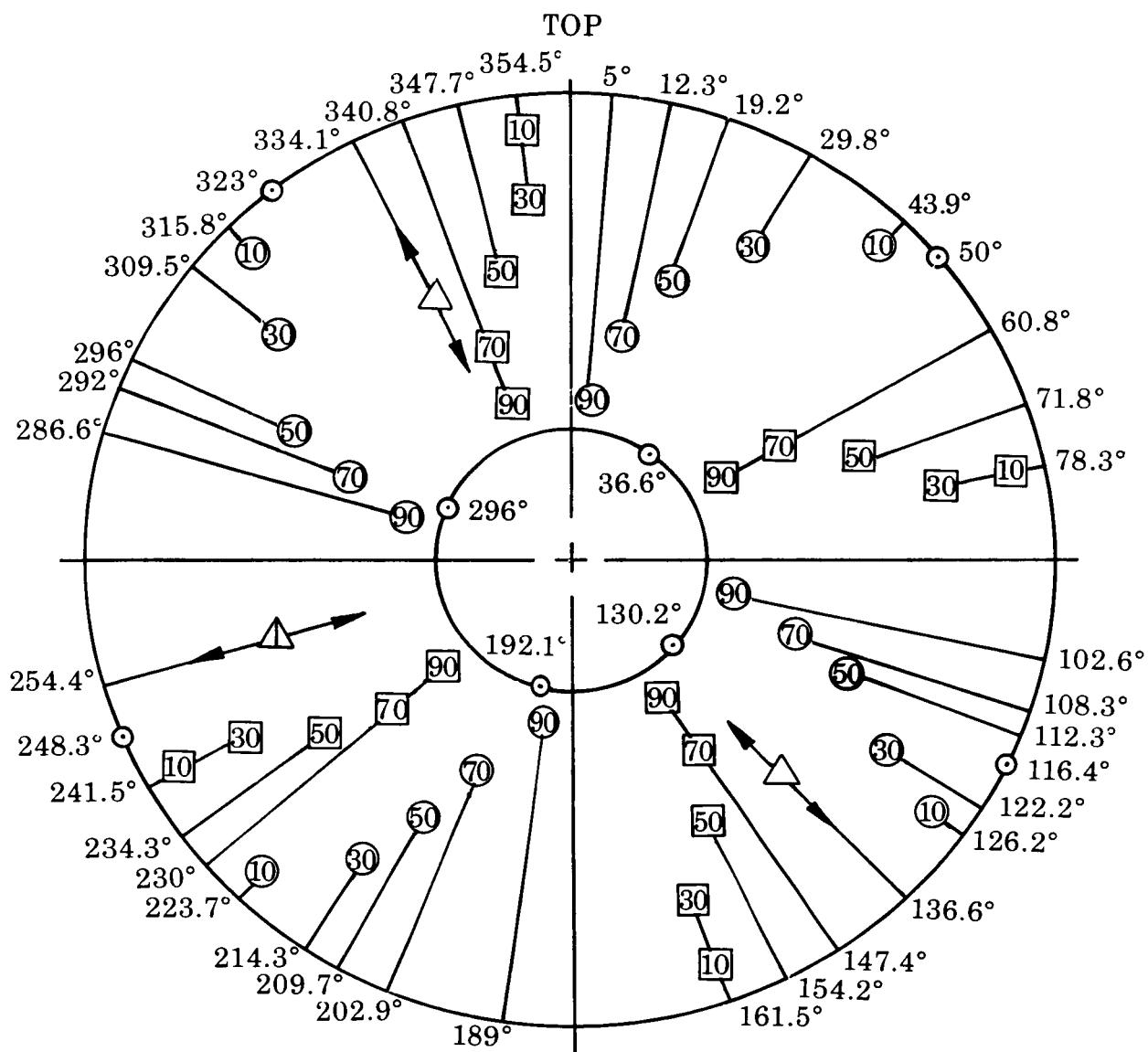
FD 18595B



Probe angular position is measured clockwise from the top.

Figure III-9. Instrumentation, Station 2A (View Looking Downstream)

FD 18594B



- Wall Static
- △ Traverse Wedge Probe, 20°
- △ Traverse Wedge Probe, 8°
- Kiel Probe *
- Temperature *

Probe angular position is measured clockwise from the top.

*Radial location as a percent of span from tip is denoted by the number within the symbol

Figure III-10. Instrumentation, Station 3
(View Looking Downstream)

FD 18597B

Note: All Dimensions Are in Inches.

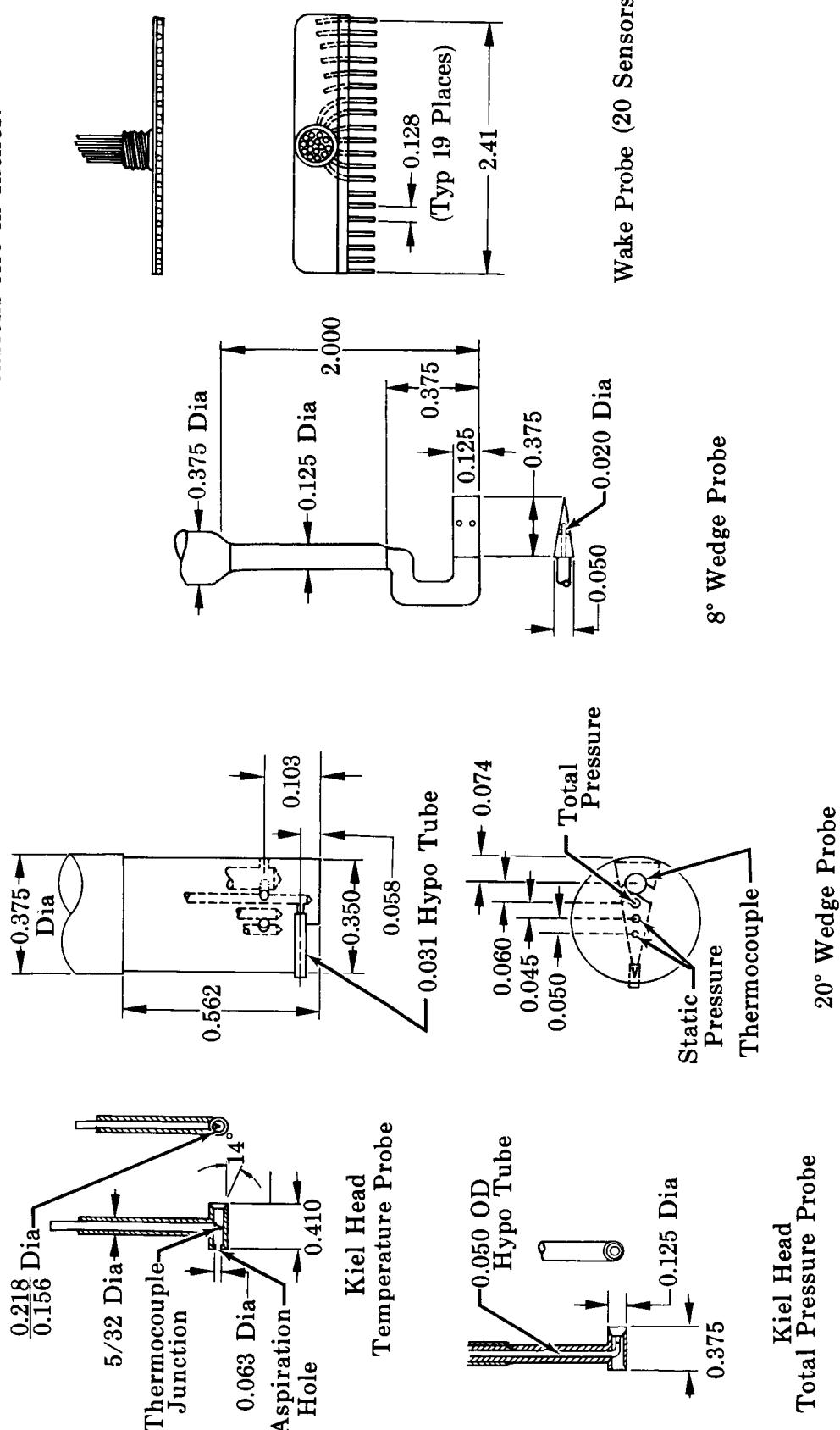


Figure III-11. Probe Configurations

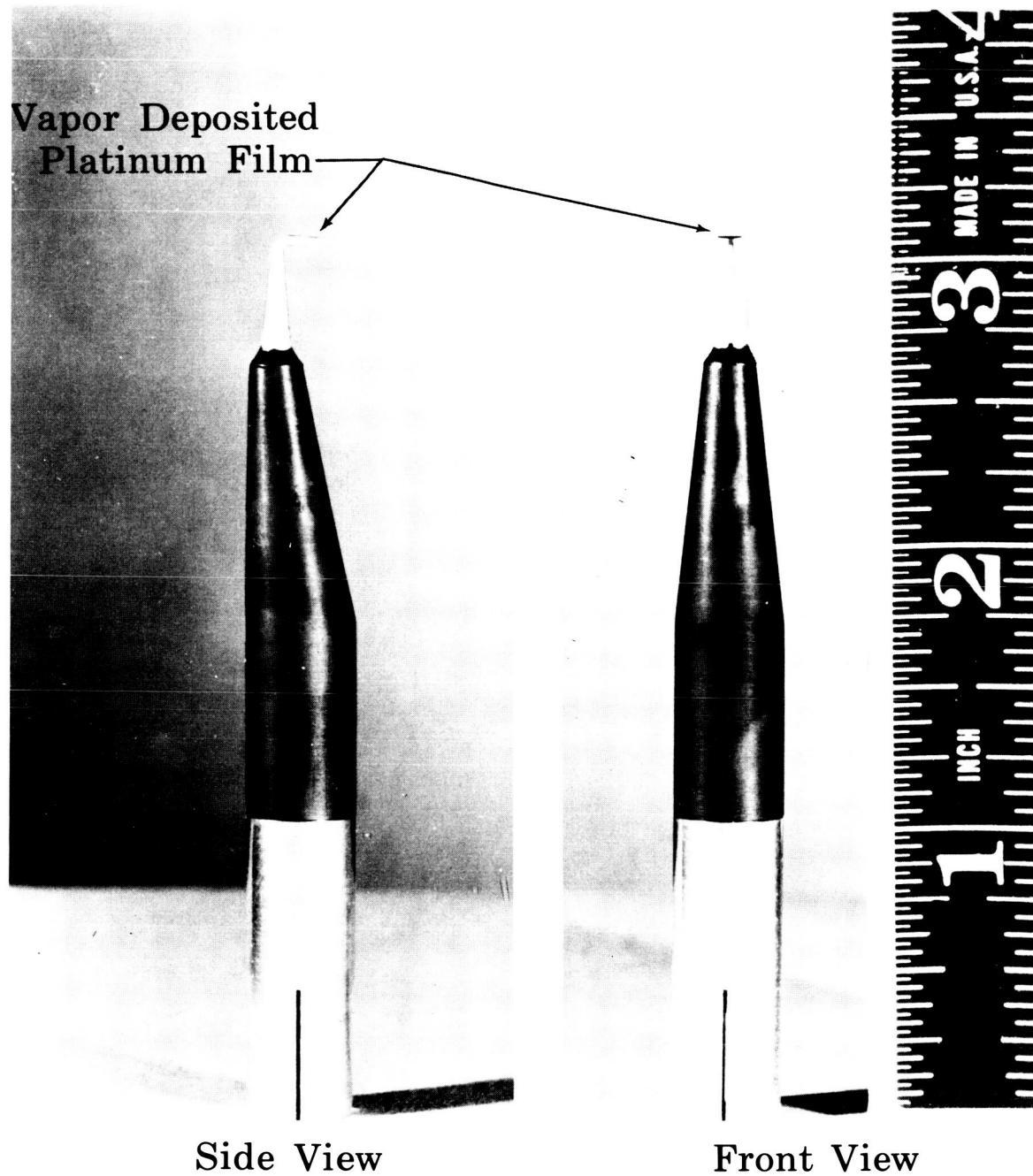


Figure III-12. Hot Film Anemometer Probe

FD 18603

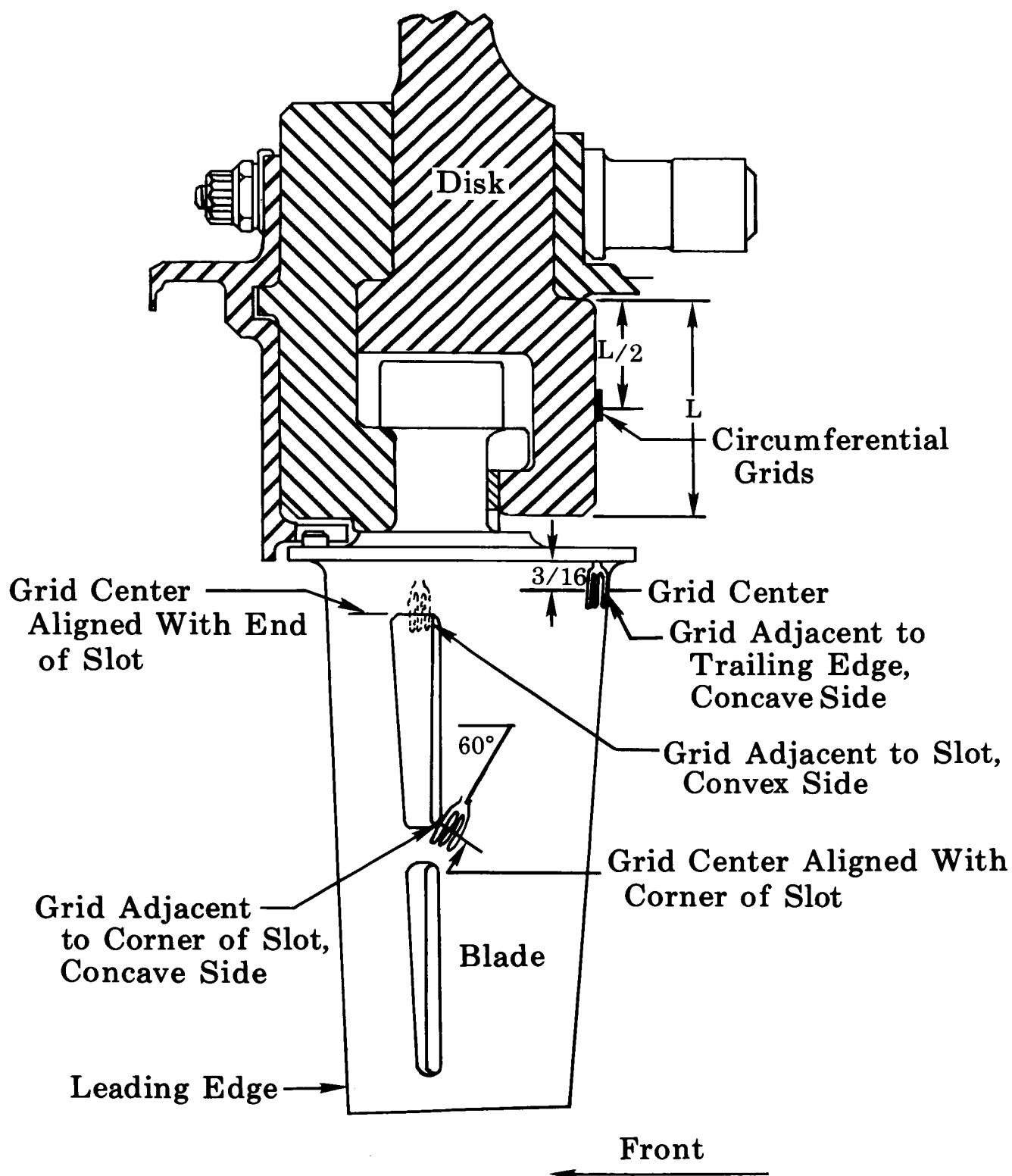


Figure III-13. Strain Gage Locations

FD 18598 A

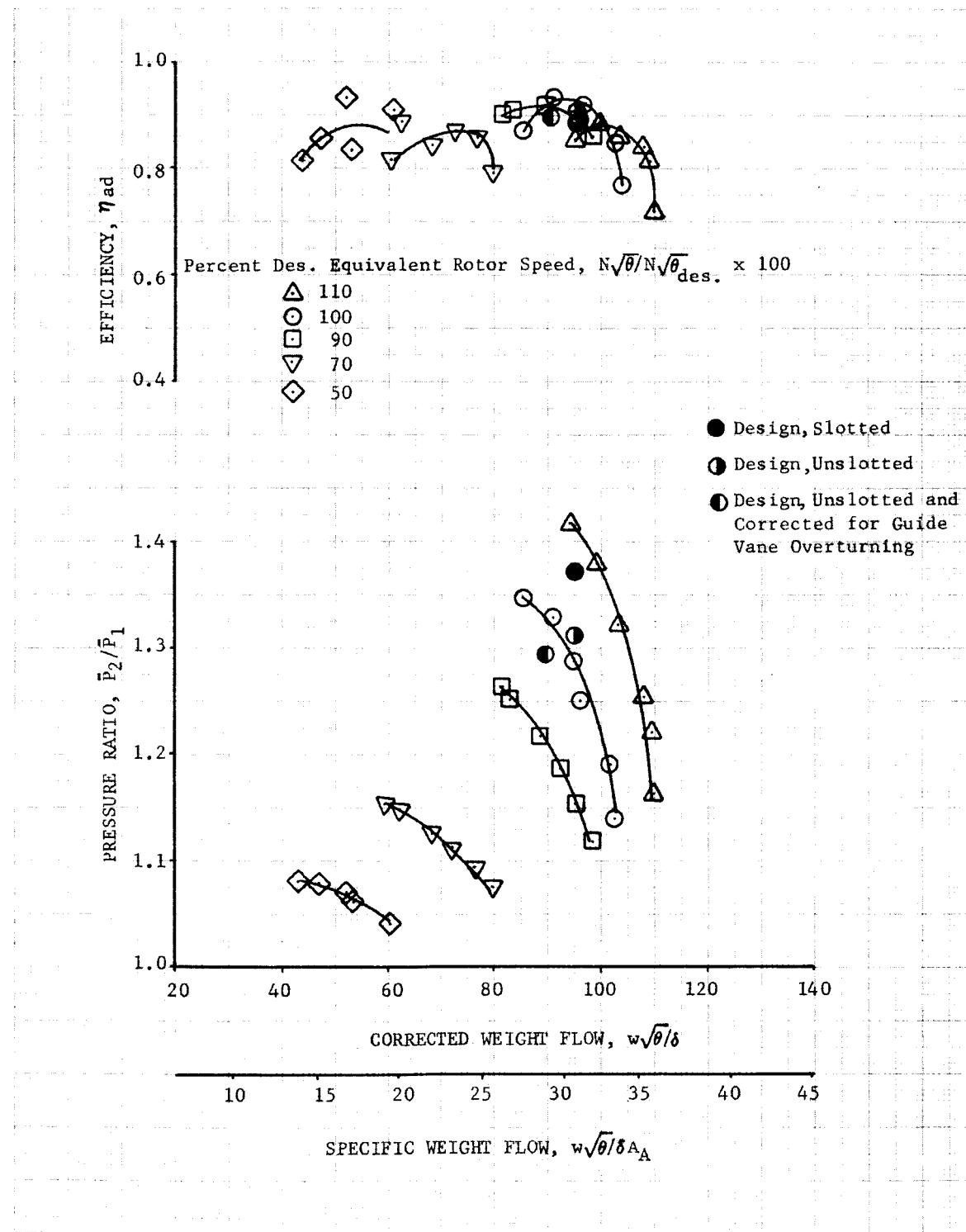


Figure V-1. Overall Performance, Slotted Rotor 1 Only

DF 51519

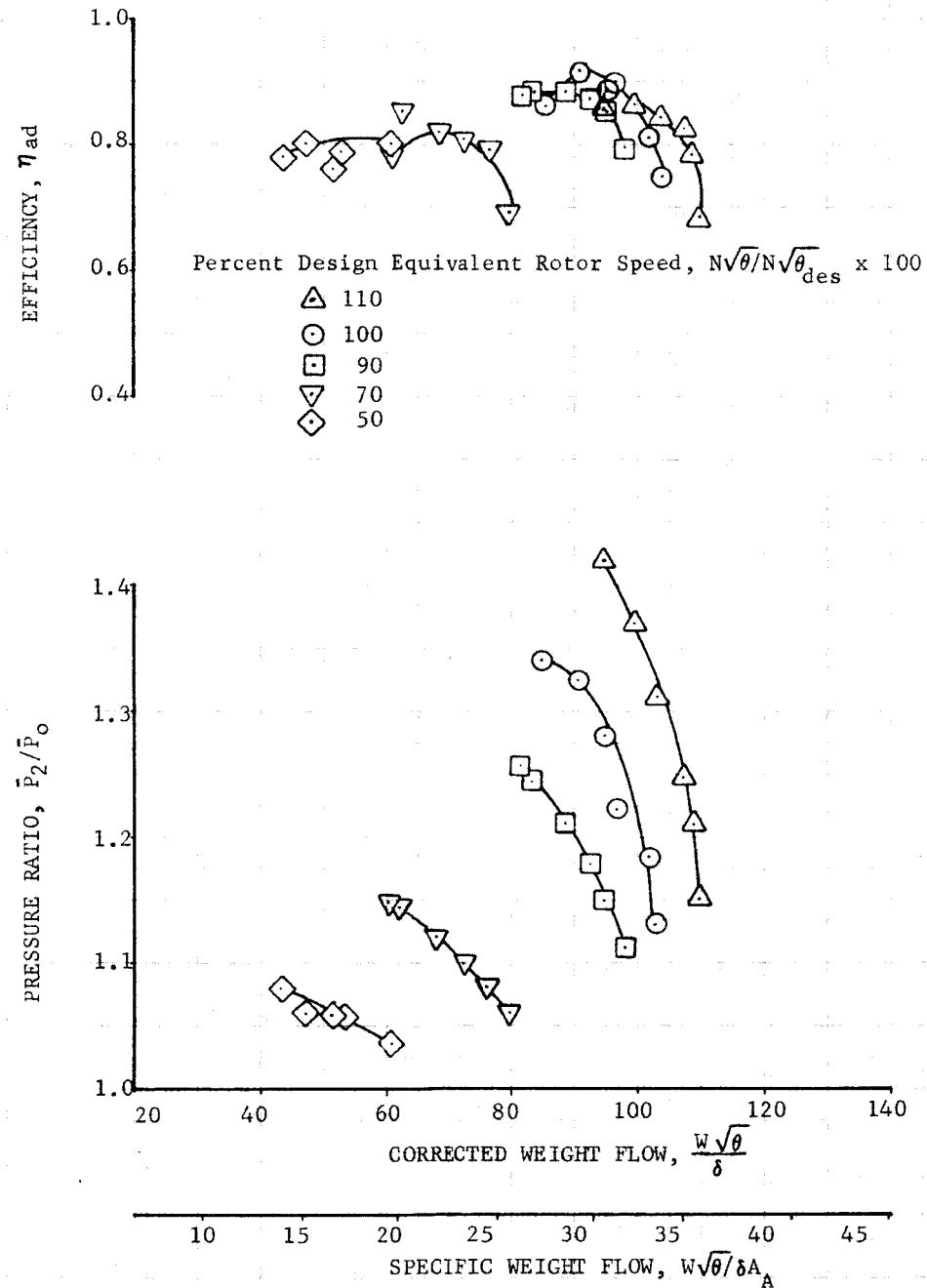


Figure V-2. Overall Performance, Inlet Guide Vane, Slotted Rotor 1

DF 51520

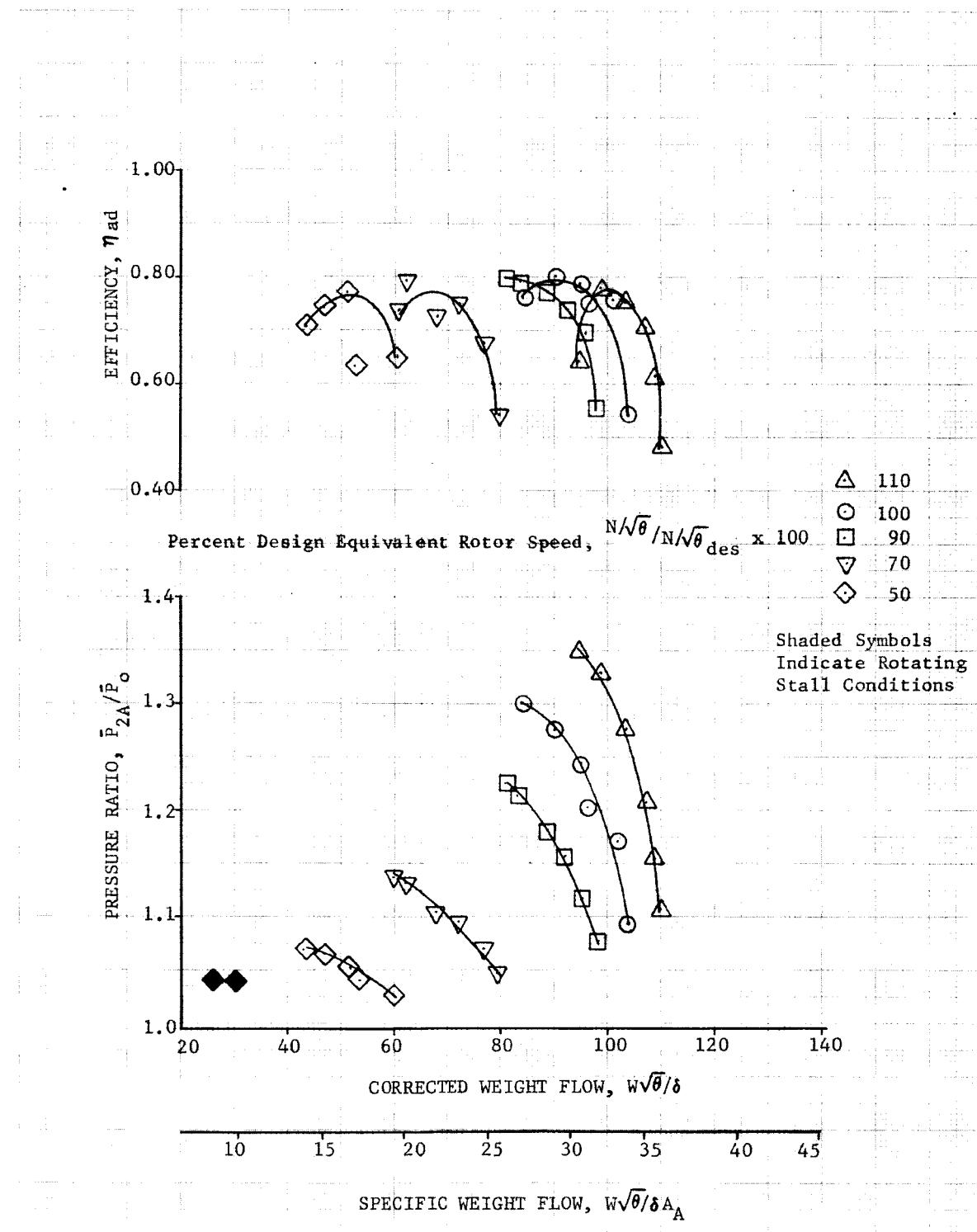


Figure V-3. Overall Performance, Guide Vane, Slotted Rotor 1, Unslopped Stator 1 DF 51521

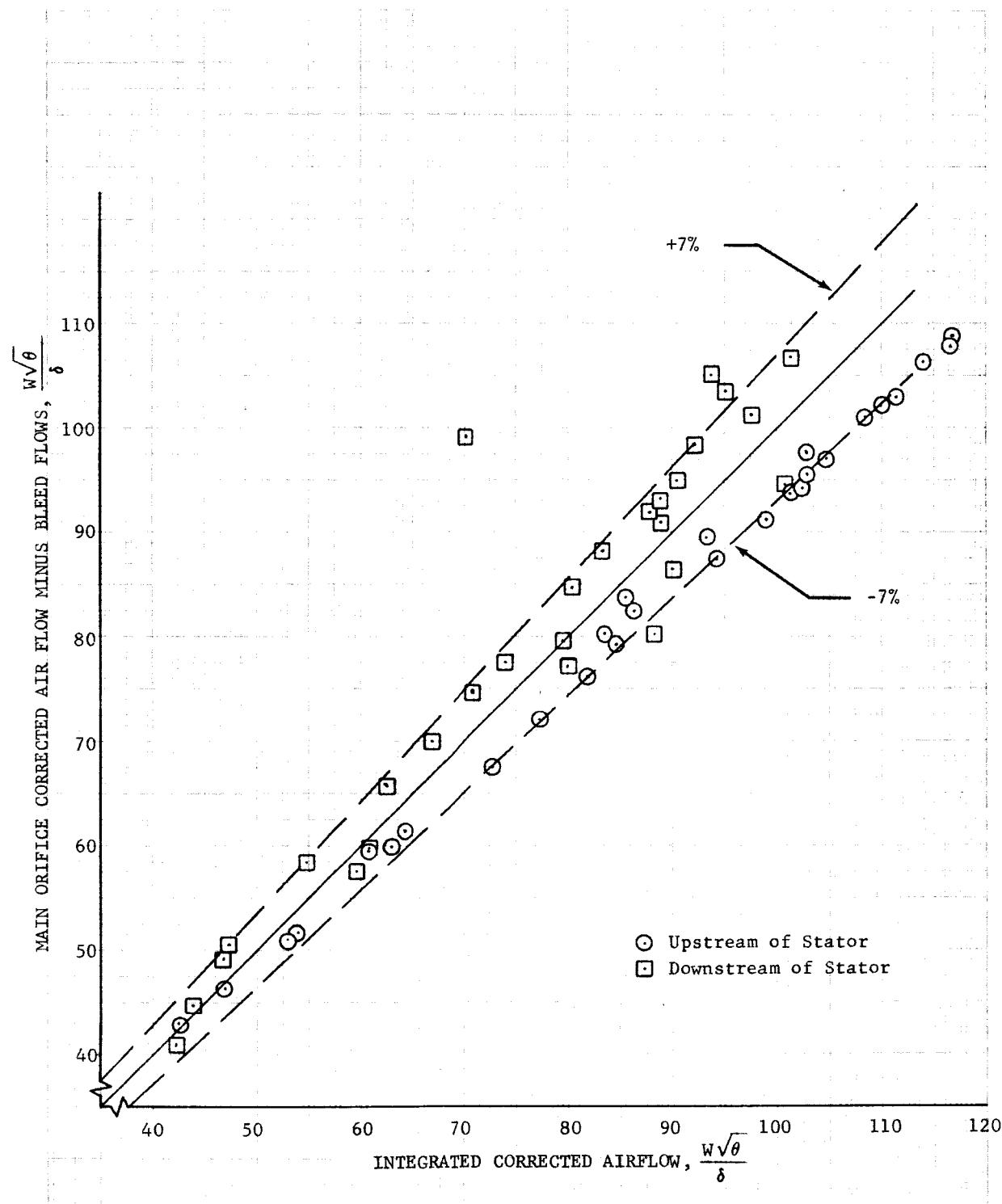


Figure V-4. Airflow Continuity Comparison

DF 52522

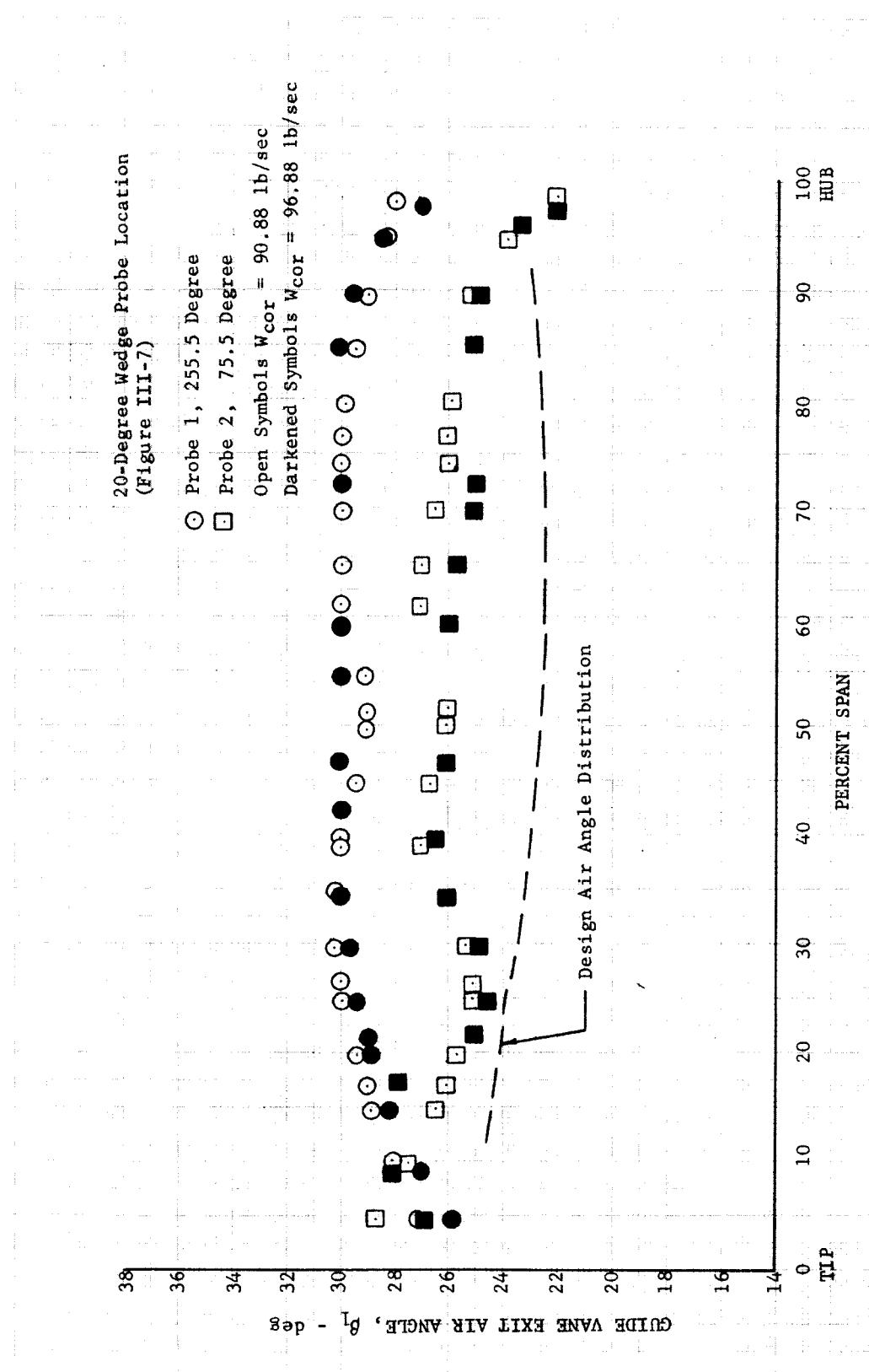
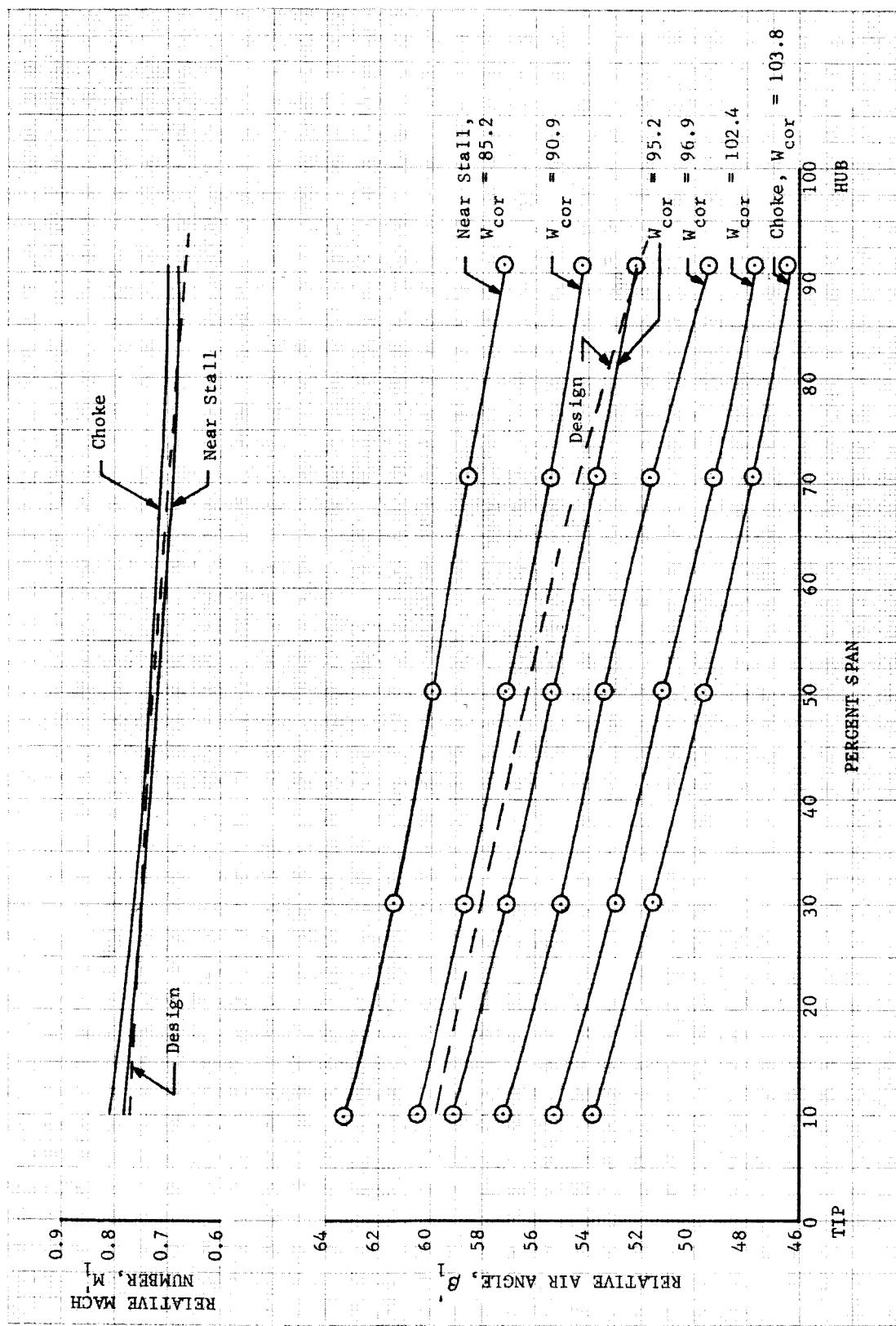


Figure V-5. Guide Vane Exit Air Angle Distribution = 100% Design Equivalent Rotor Speed

DF 52523

DF 52526

Figure V-6. Relative Air Angle and Mach Number Distribution into Slotted Rotor 1,
100% Design Equivalent Rotor Speed



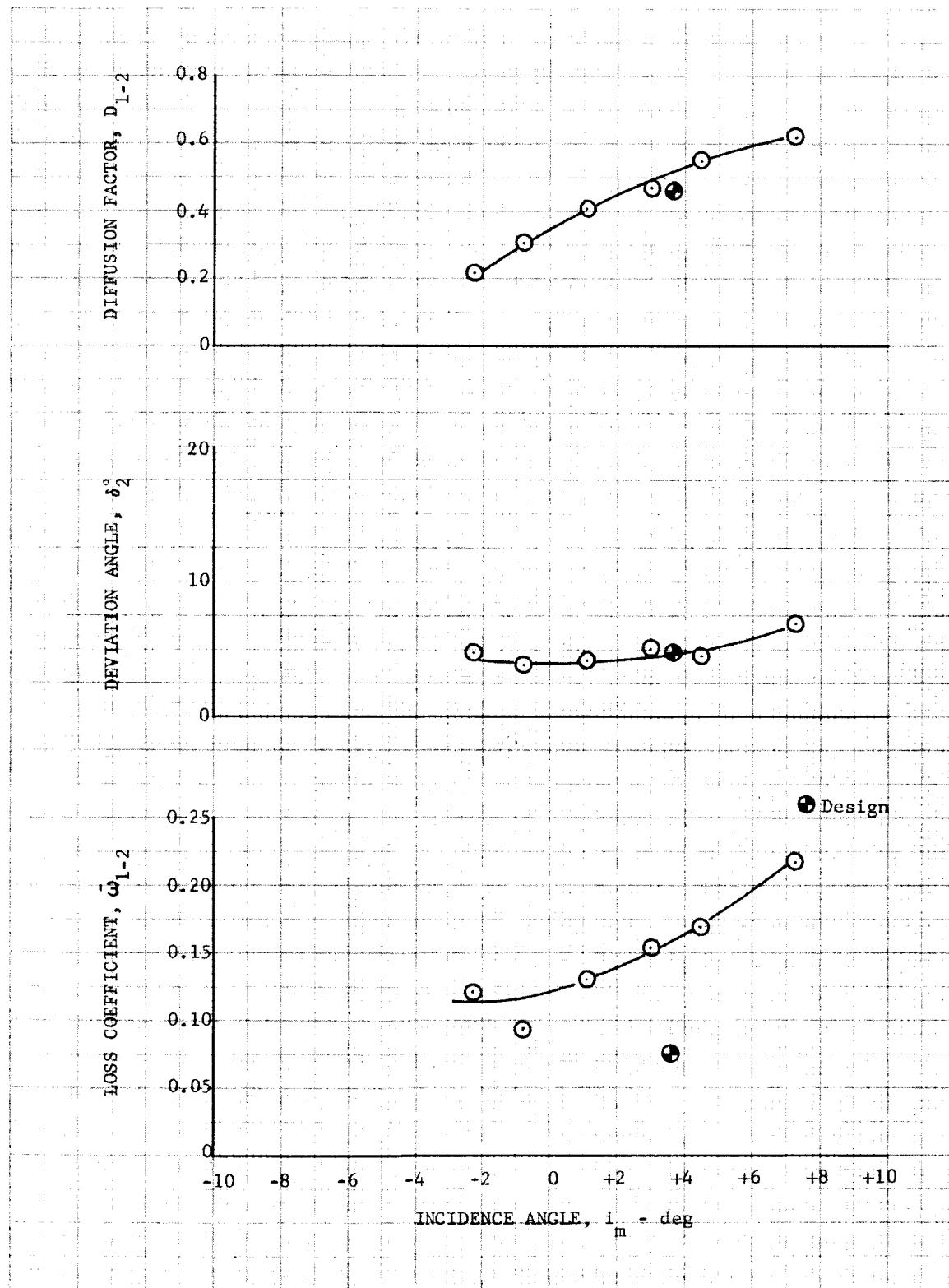


Figure V-7. Rotor Blade Element Performance, 100% Design
Equivalent Rotor Speed, 10% Span from Tip

DF 52542

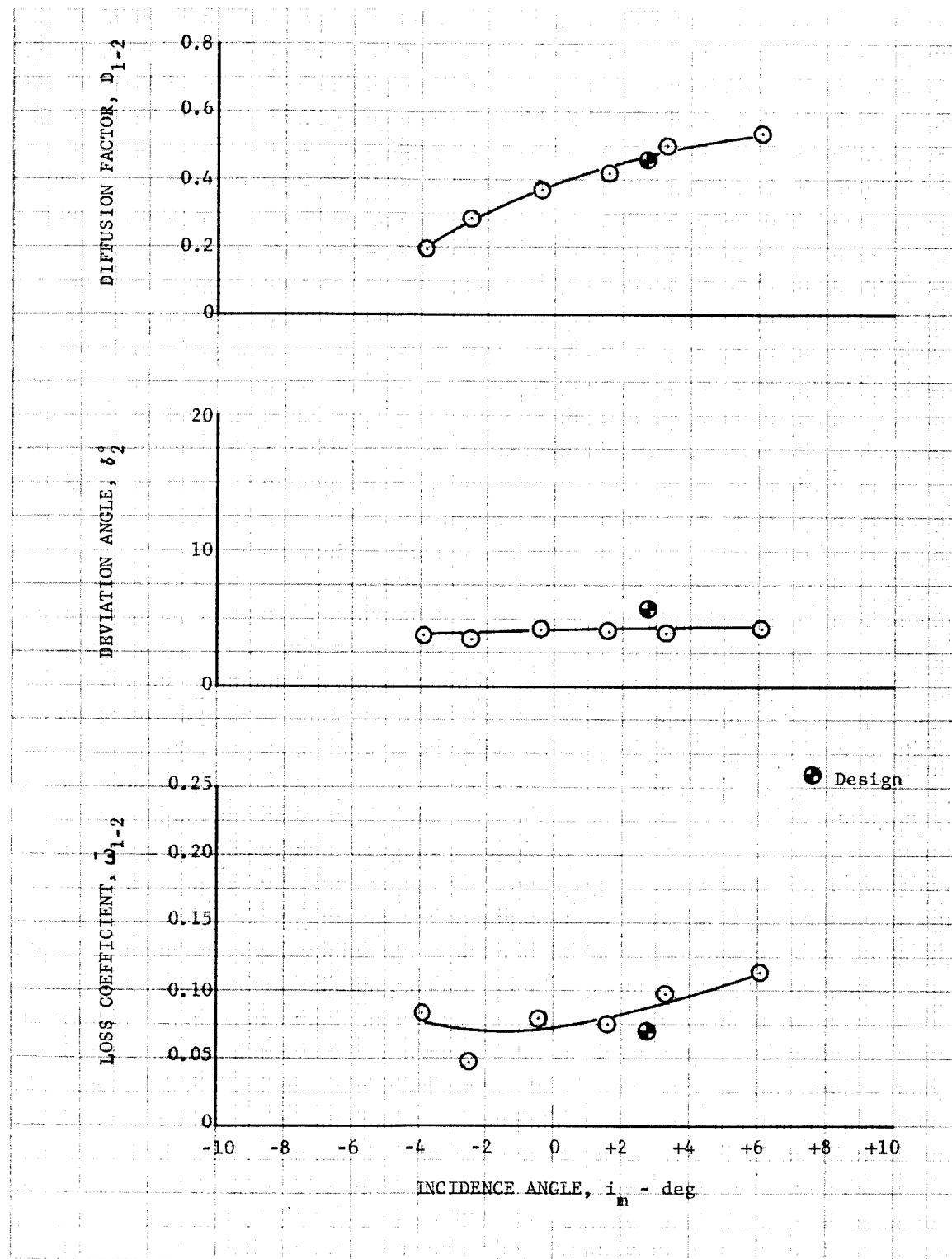


Figure V-8. Rotor Blade Element Performance, 100% Design
Equivalent Rotor Speed, 30% Span from Tip

DF 52543

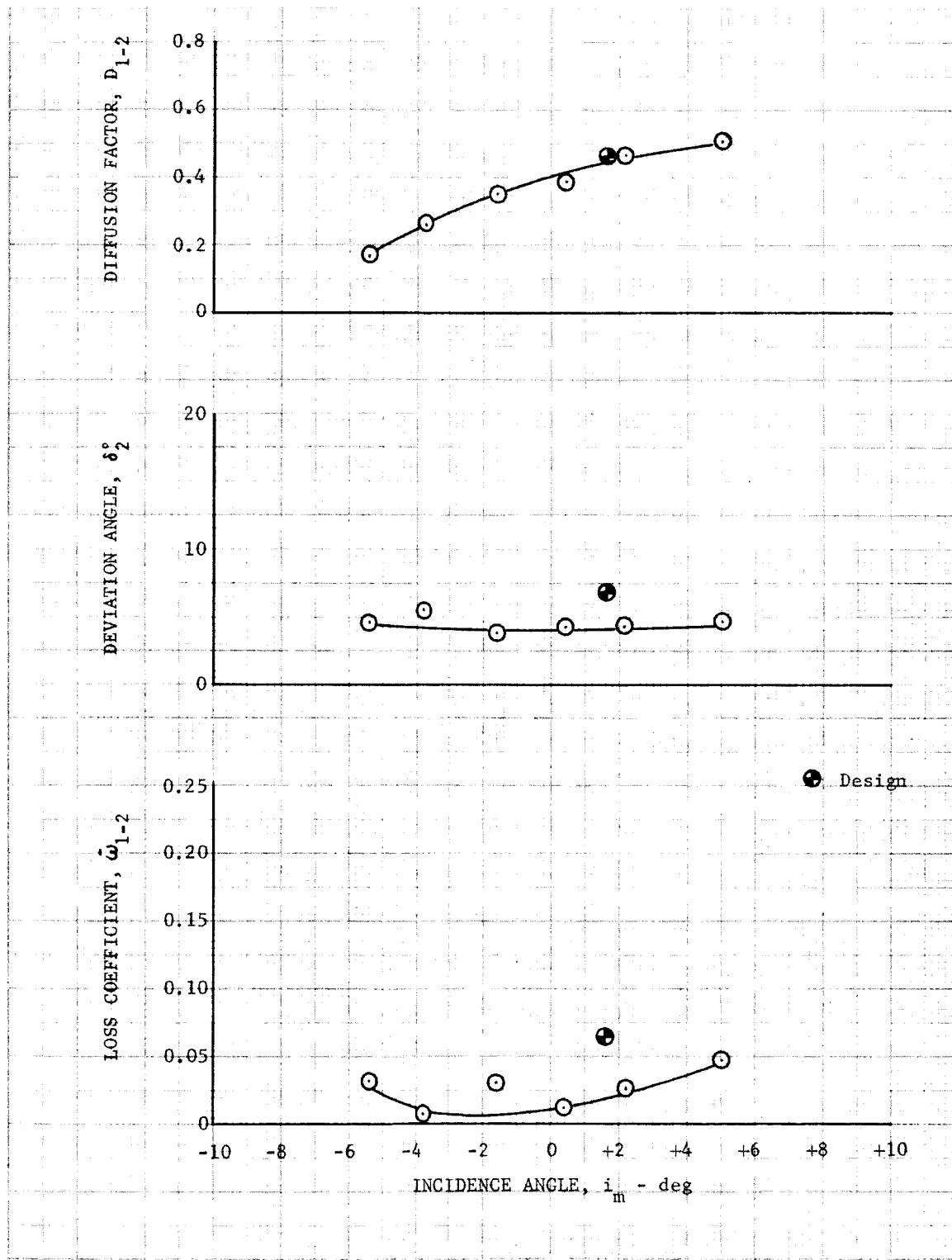


Figure V-9. Rotor Blade Element Performance, 100% Design
Equivalent Rotor Speed, 50% Span from Tip

DF 52544

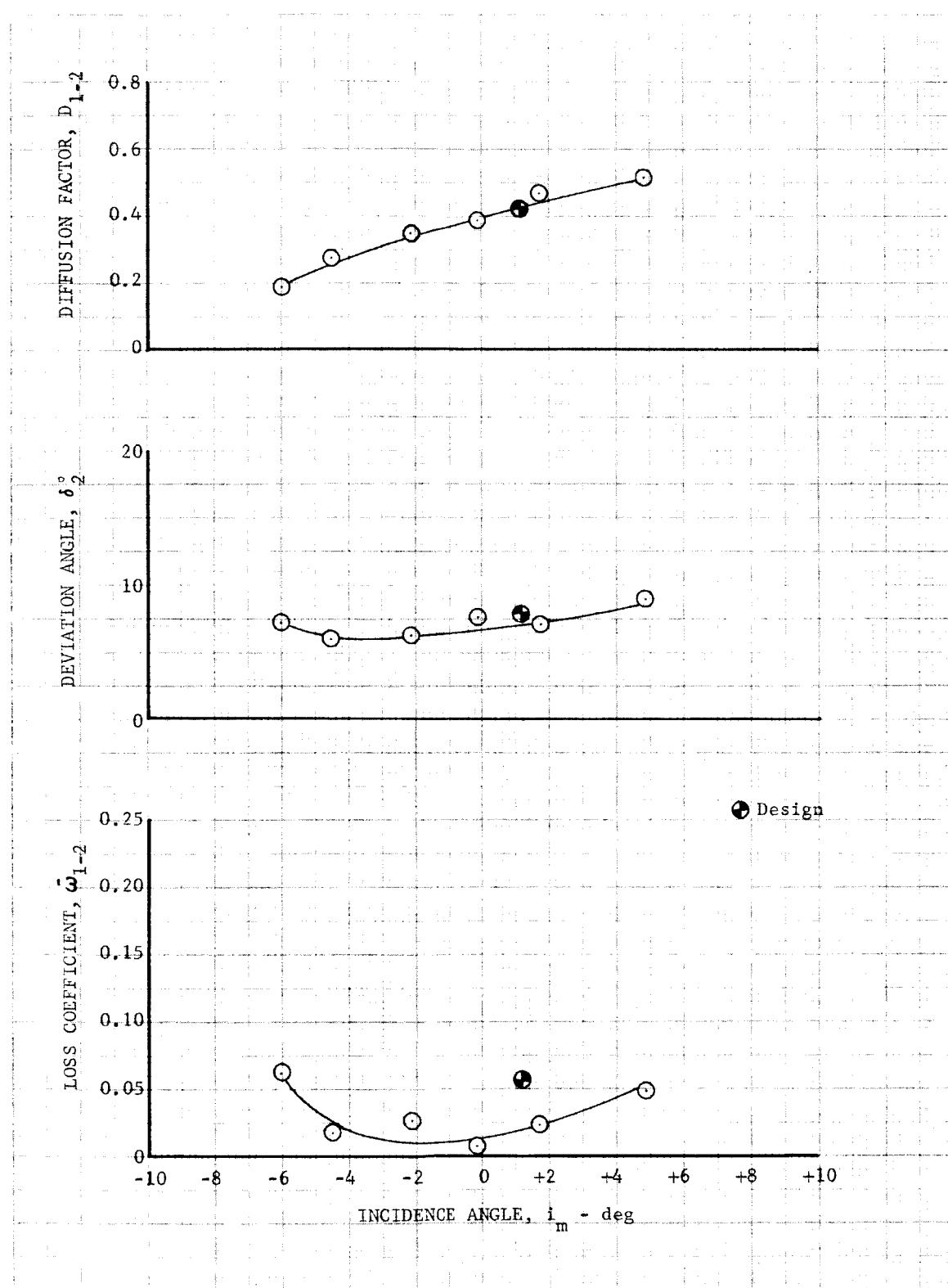


Figure V-10. Rotor Blade Element Performance, 100% Design
Equivalent Rotor Speed, 70% Span from Tip

DF 52545

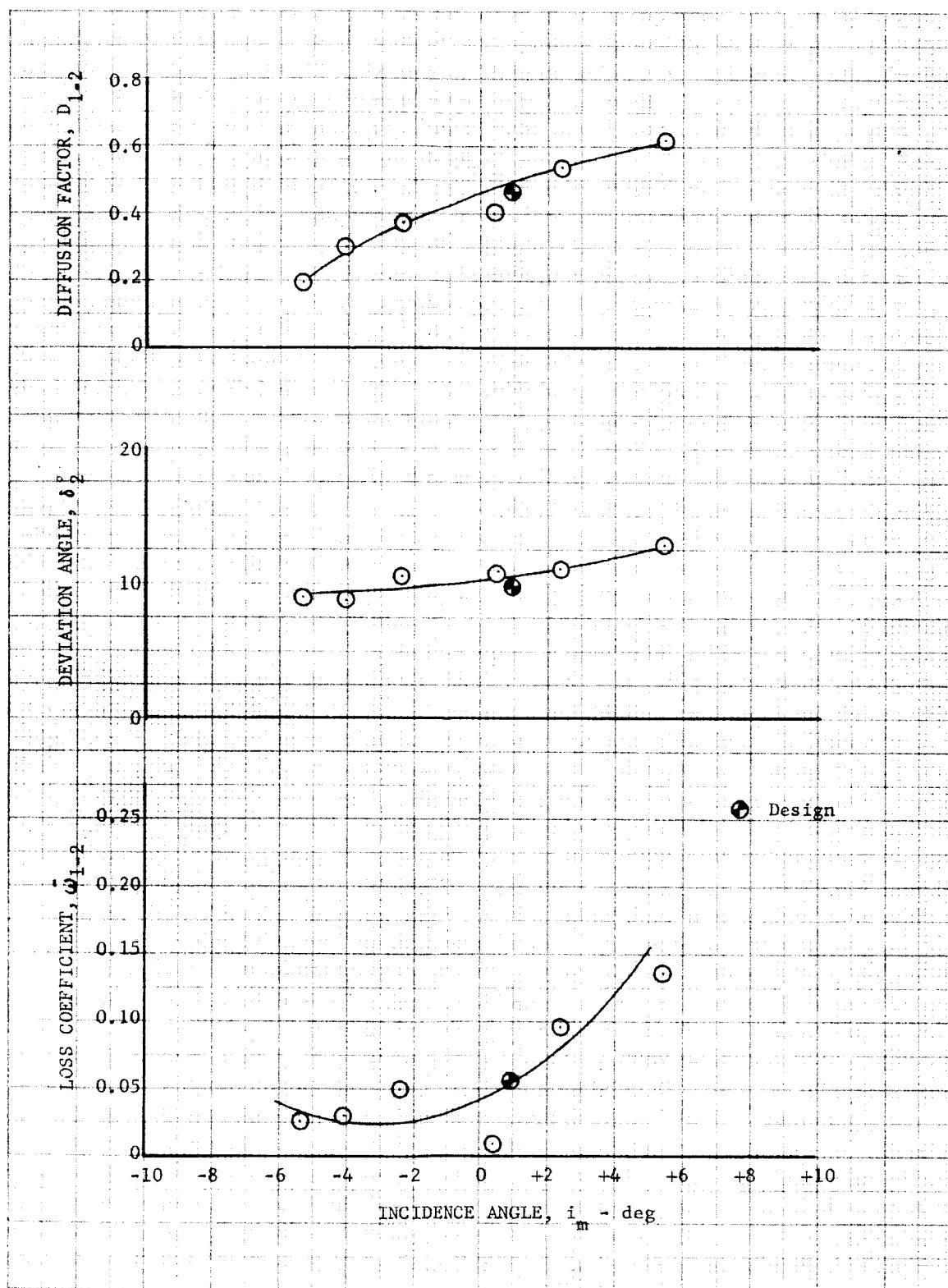


Figure V-11. Rotor Blade Element Performance, 100% Design
Equivalent Rotor Speed, 90% Span from Tip

DF 52546

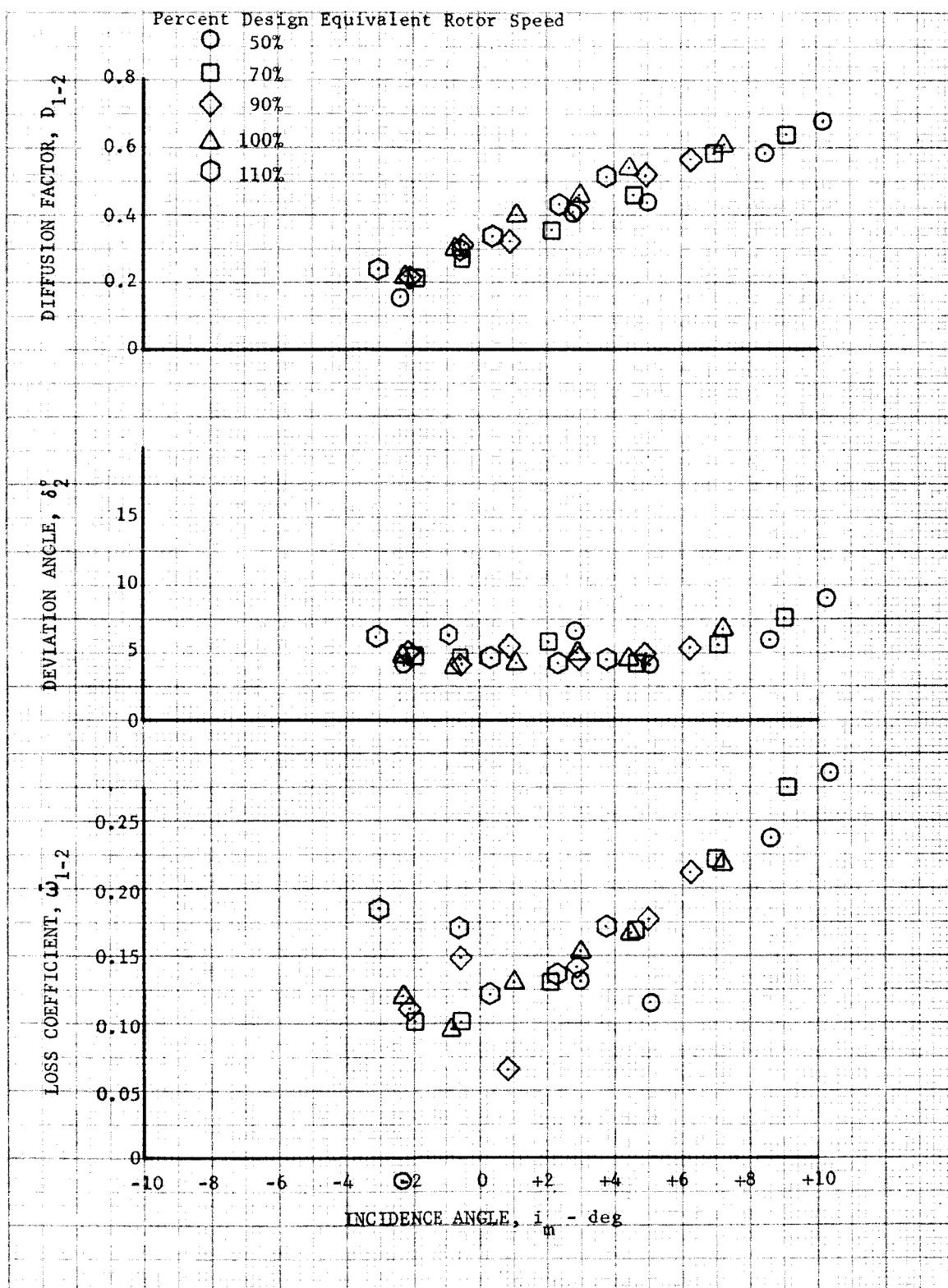


Figure V-12. Variation of Blade Element Parameters With Incidence, Slotted Rotor 1, 10% Span from Tip

DF 52552

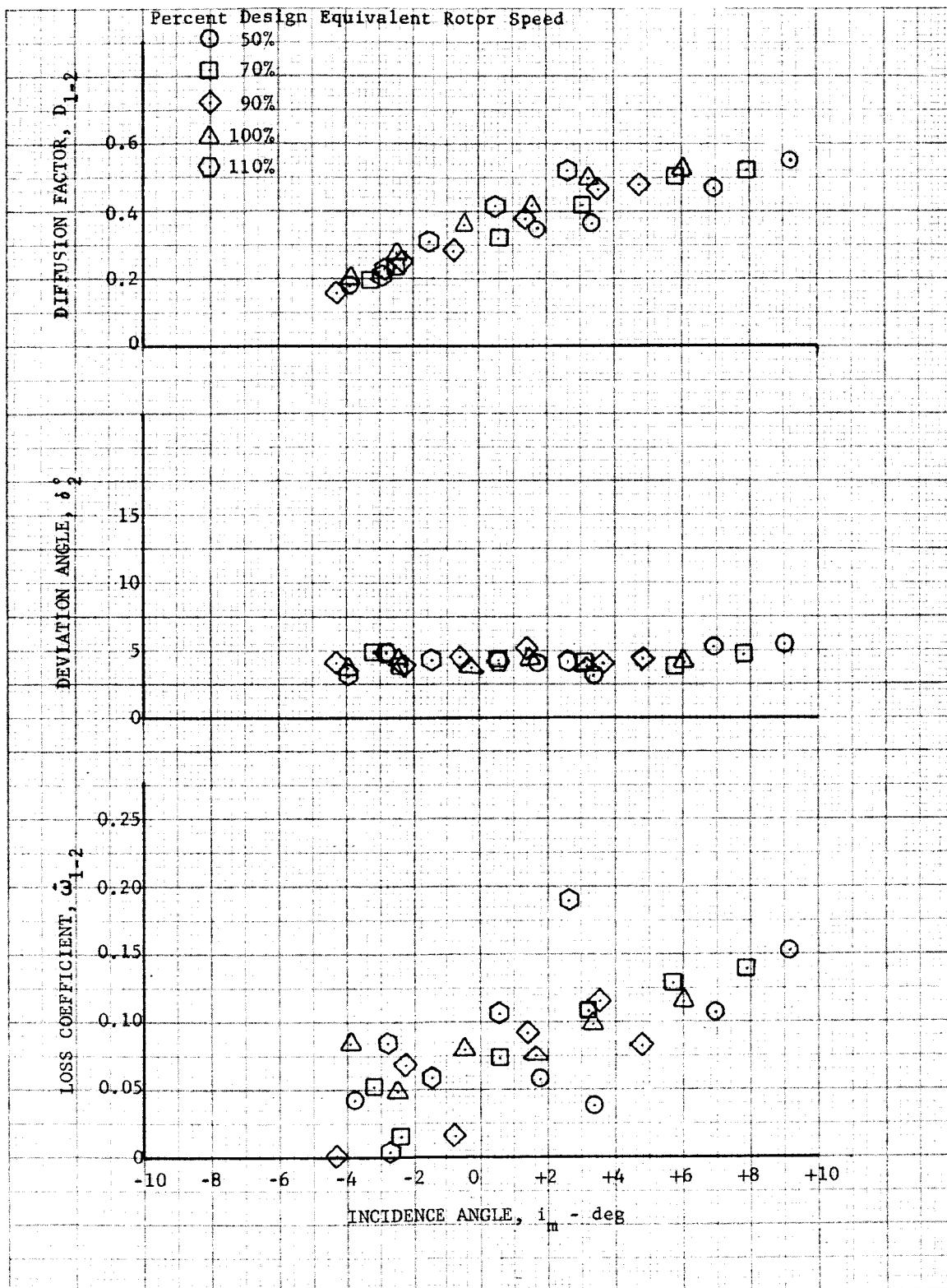


Figure V-13. Variation of Blade Element Parameters With Incidence, Slotted Rotor 1, 30% Span from Tip

DF 52553

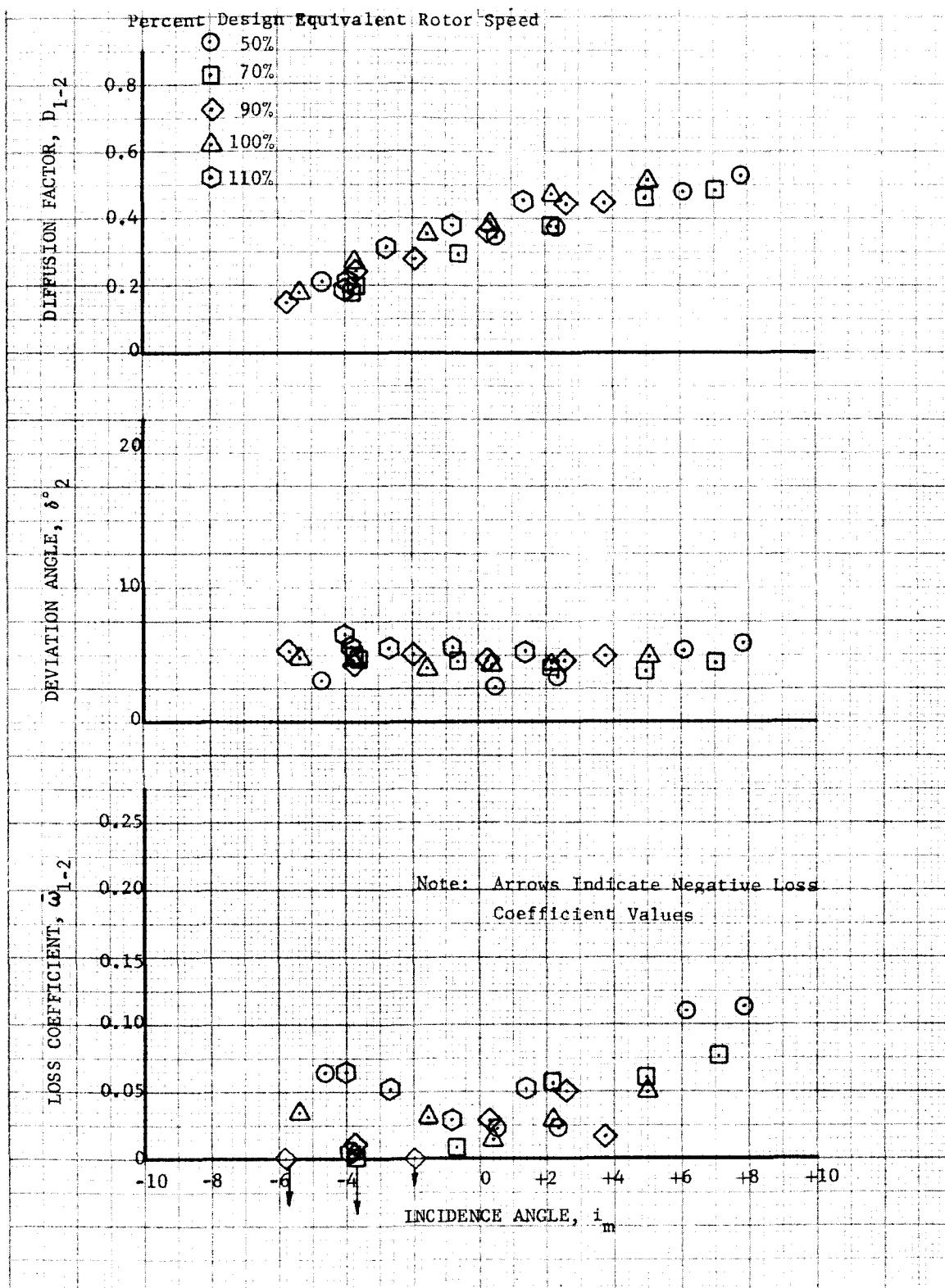


Figure V-14. Variation of Blade Element Parameters With Incidence, Slotted Rotor 1, 50% Span from Tip

DF 52554

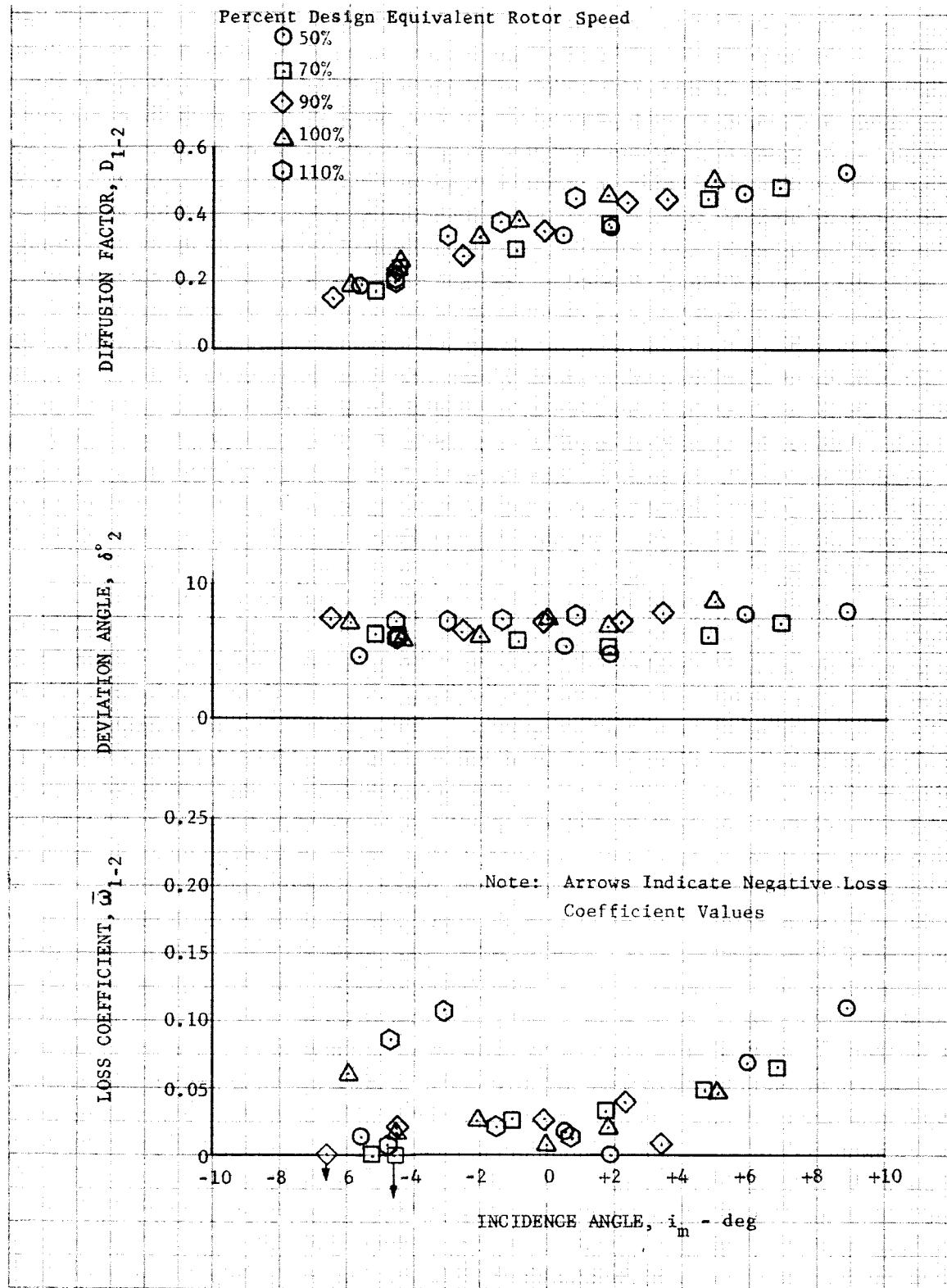


Figure V-15. Variation of Blade Element Parameters With Incidence, Slotted Rotor 1, 70% Span from Tip

DF 52555

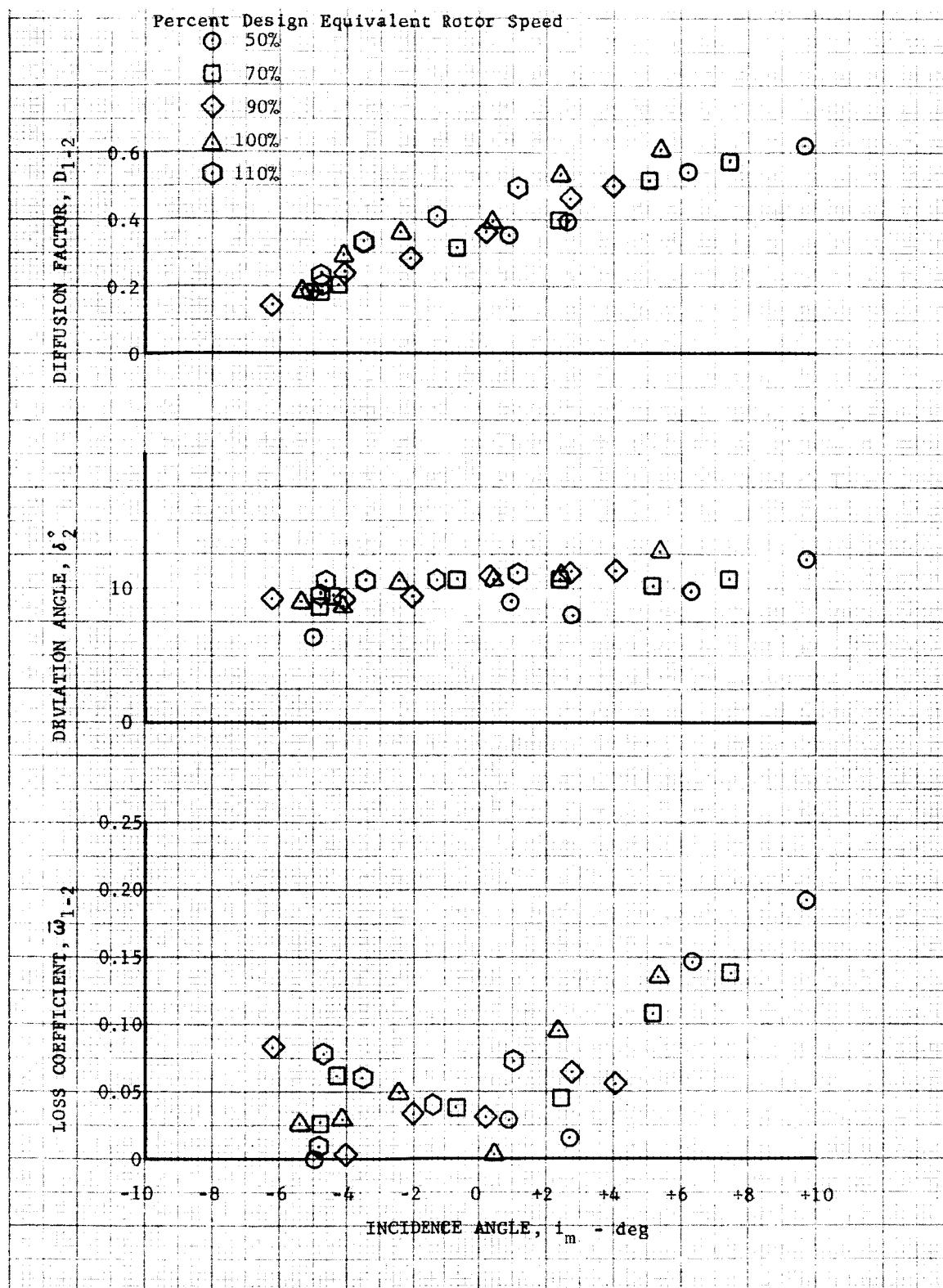


Figure V-16. Variation of Blade Element Parameters With Incidence, Slotted Rotor 1, 90% Span from Tip

DF 52556

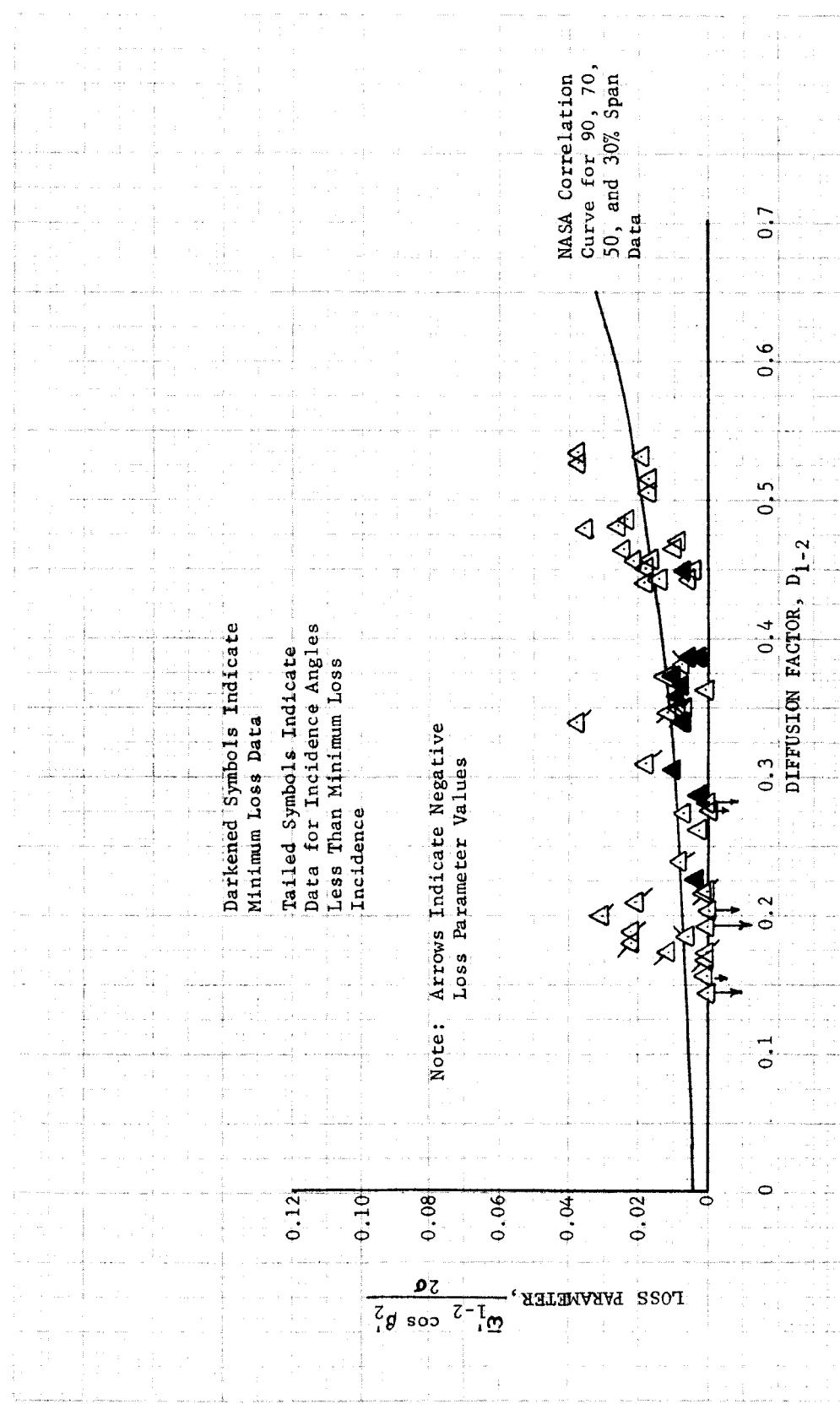


Figure V-17a. Loss Parameter Versus Diffusion Factor at 70 and 50% Span (From Tip) - 90, 100, and 110% Design Equivalent Rotor Speed
DF 53005-2

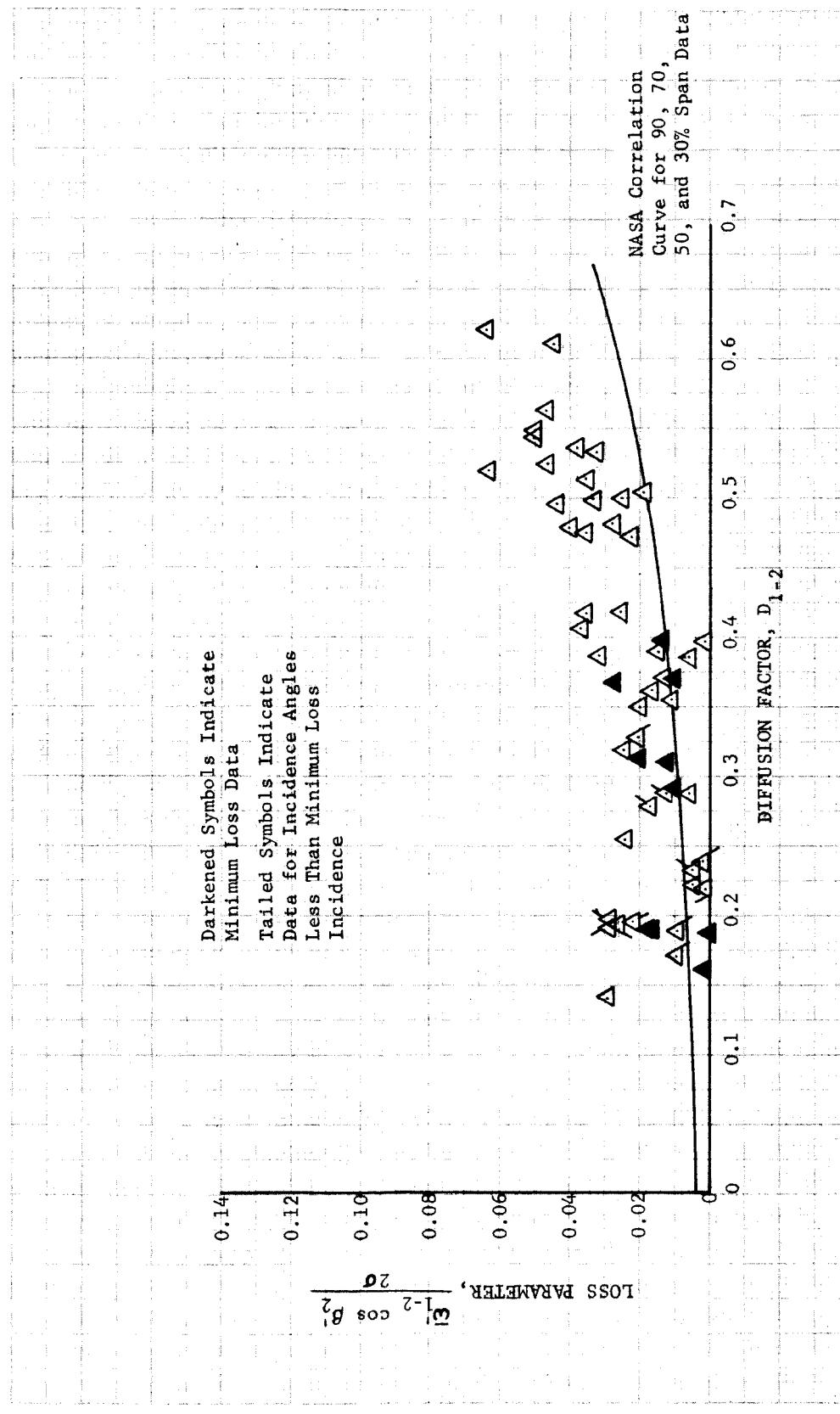


Figure V-17b. Loss Parameter Versus Diffusion Factor at 90 and 30% Span (From Tip) - 90, 100, and 110% Design Equivalent Rotor Speed DF 53005-3

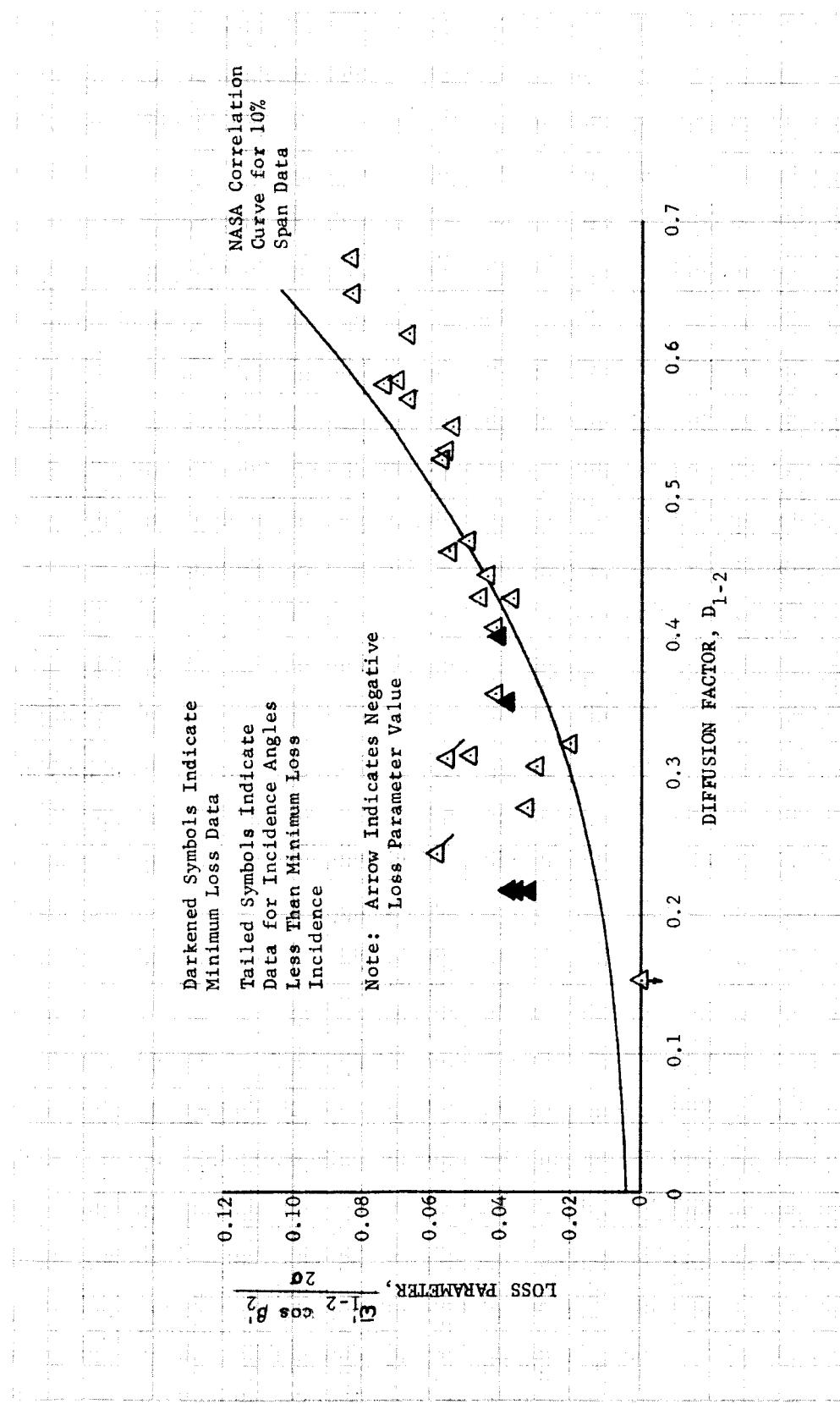


Figure V-17c. Loss Parameter Versus Diffusion Factor at 10% Span (From Tip) - 90, 100, and 110% Design Equivalent Rotor Speed
DF 53005-1

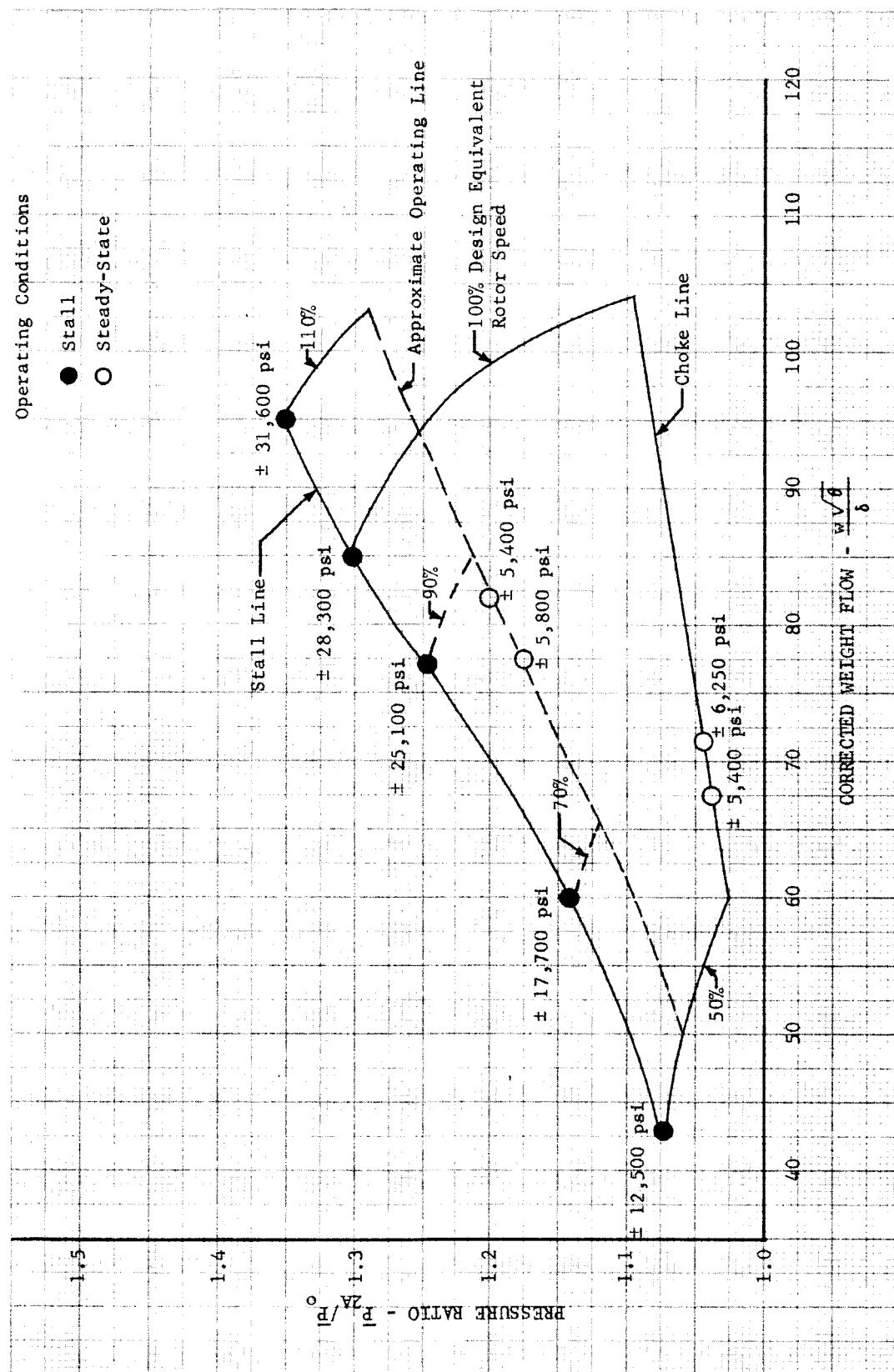


Figure V-18. Stress Survey Map

DF 52558

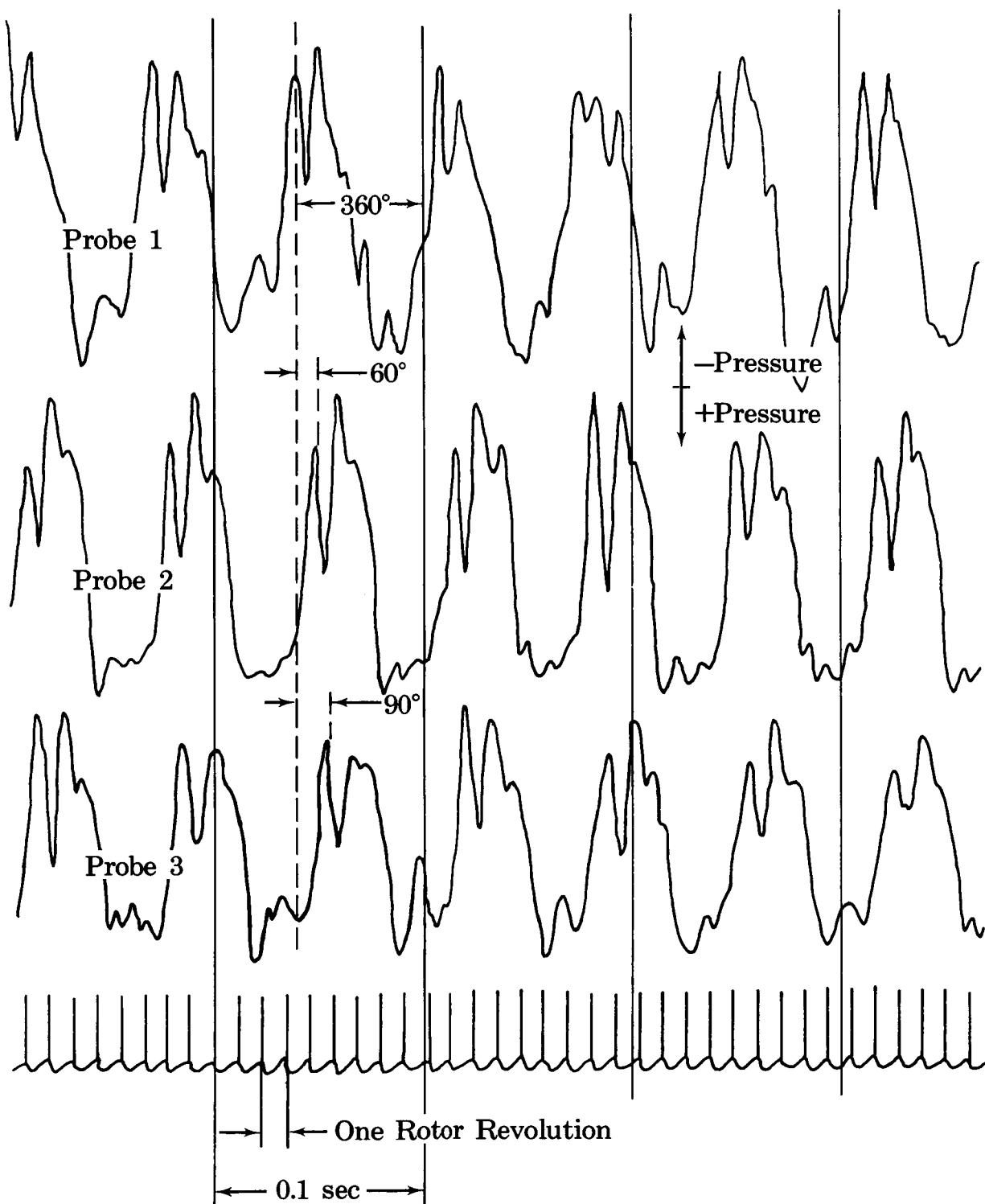


Figure V-19. Example of One Zone Stall, Rotor Speed 5220 Rpm, Oscillograph Reproduction

FD 18602

Major Scale Division: Vertical = 30 ft/sec

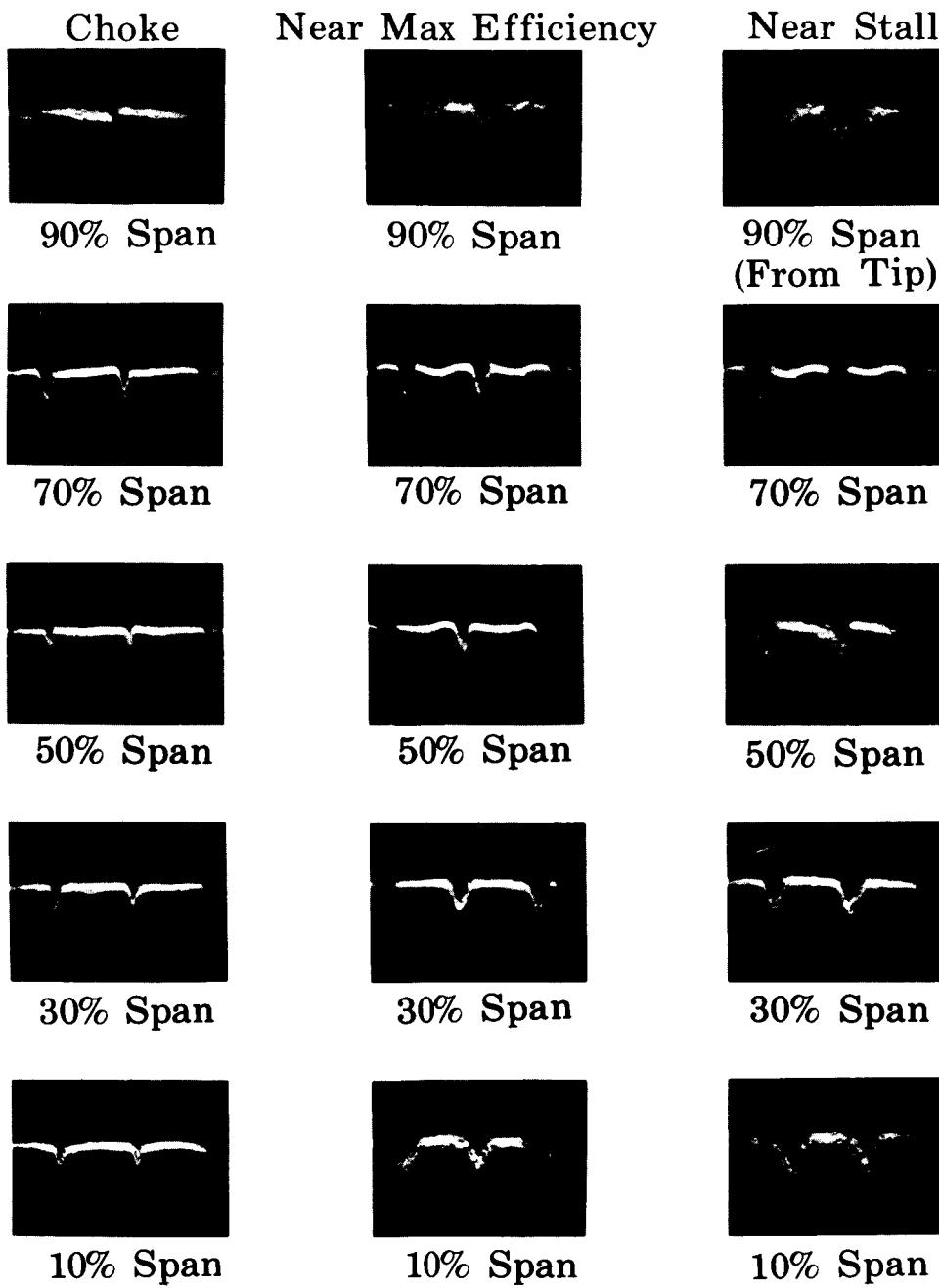


Figure V-20. Rotor Wake Surveys, 50% Design
Equivalent Rotor Speed

FD 18593A

Major Scale Division: Vertical = 30 ft/sec

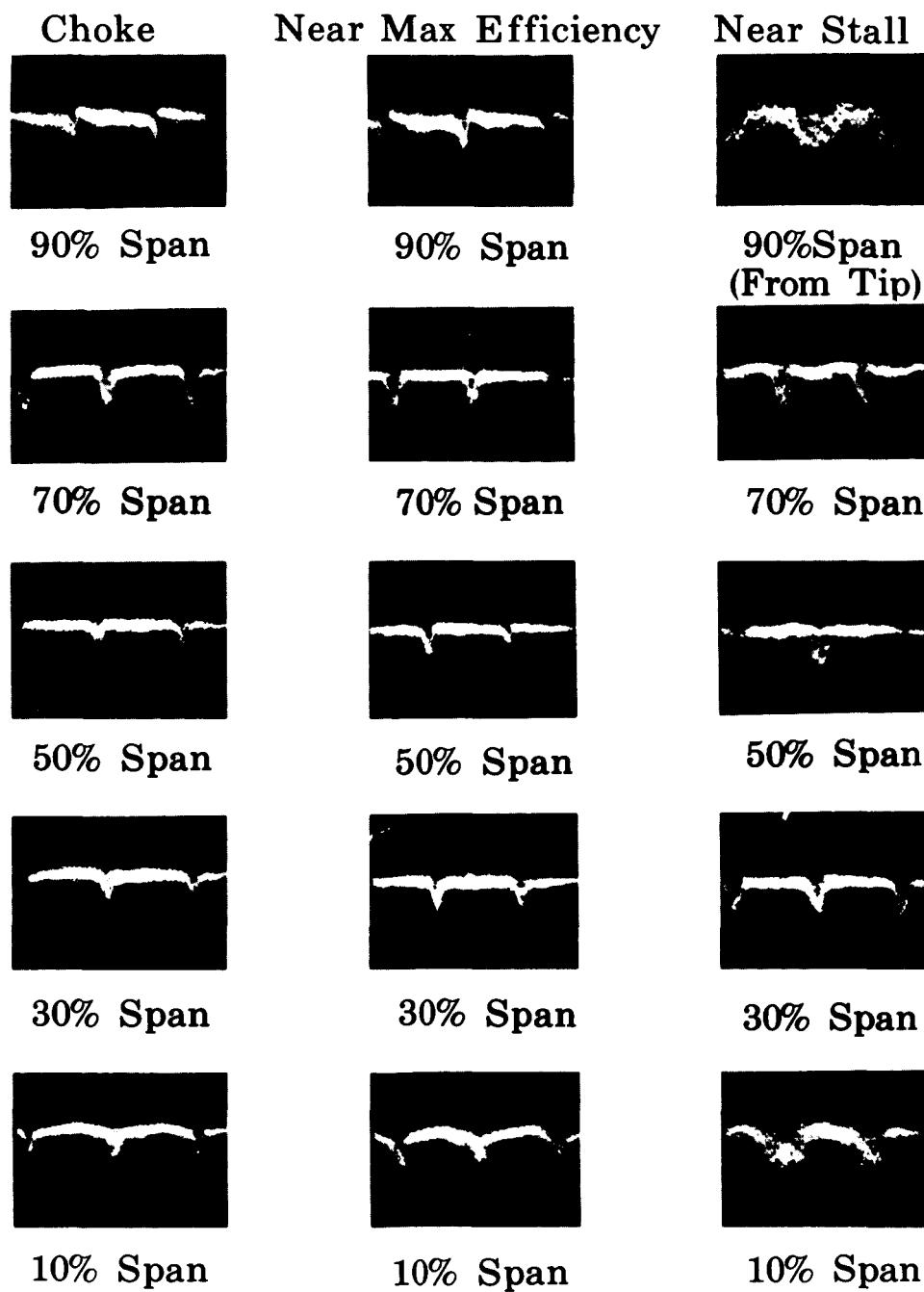


Figure V-21. Rotor Wake Surveys, 70% Design
Equivalent Rotor Speed

FD 18600A

Major Scale Division: Vertical = 30 ft/sec

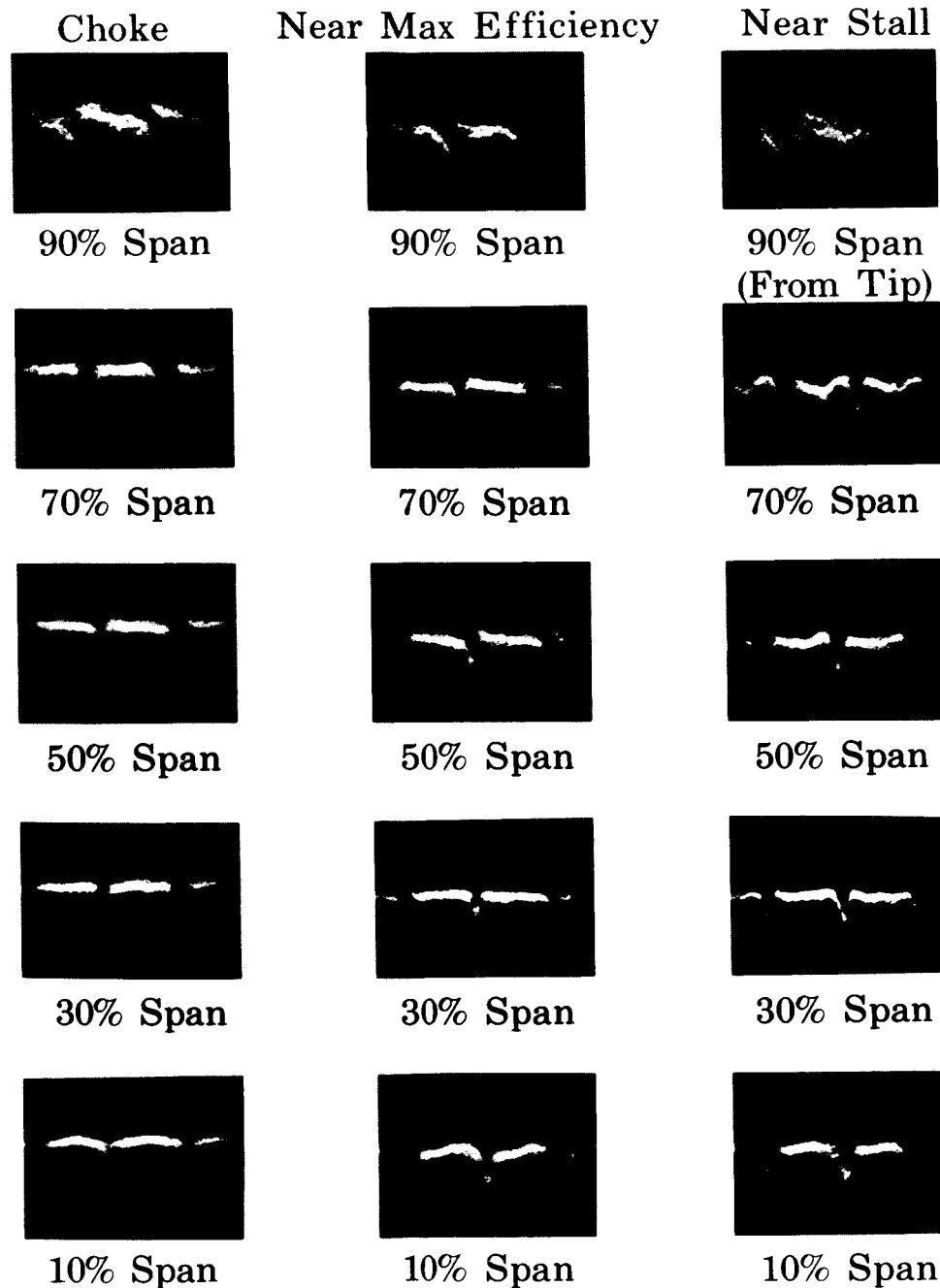


Figure V-22. Rotor Wake Surveys, 90% Design
Equivalent Rotor Speed

FD 18599A

Major Scale Division: Vertical = 30 ft/sec

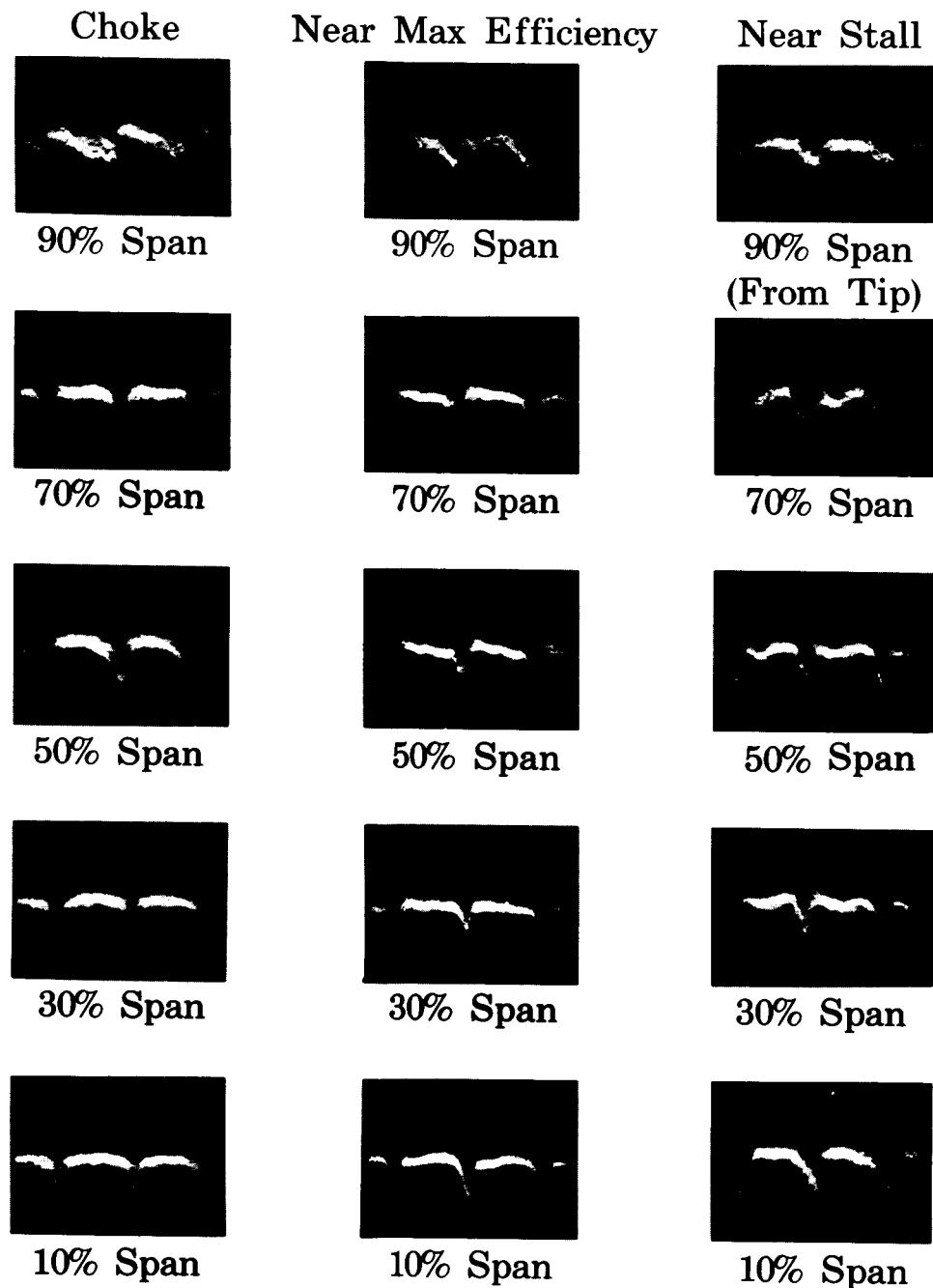


Figure V-23. Rotor Wake Surveys, Design
Equivalent Rotor Speed

FD 18592A

Major Scale Division: Vertical = 30 ft/sec

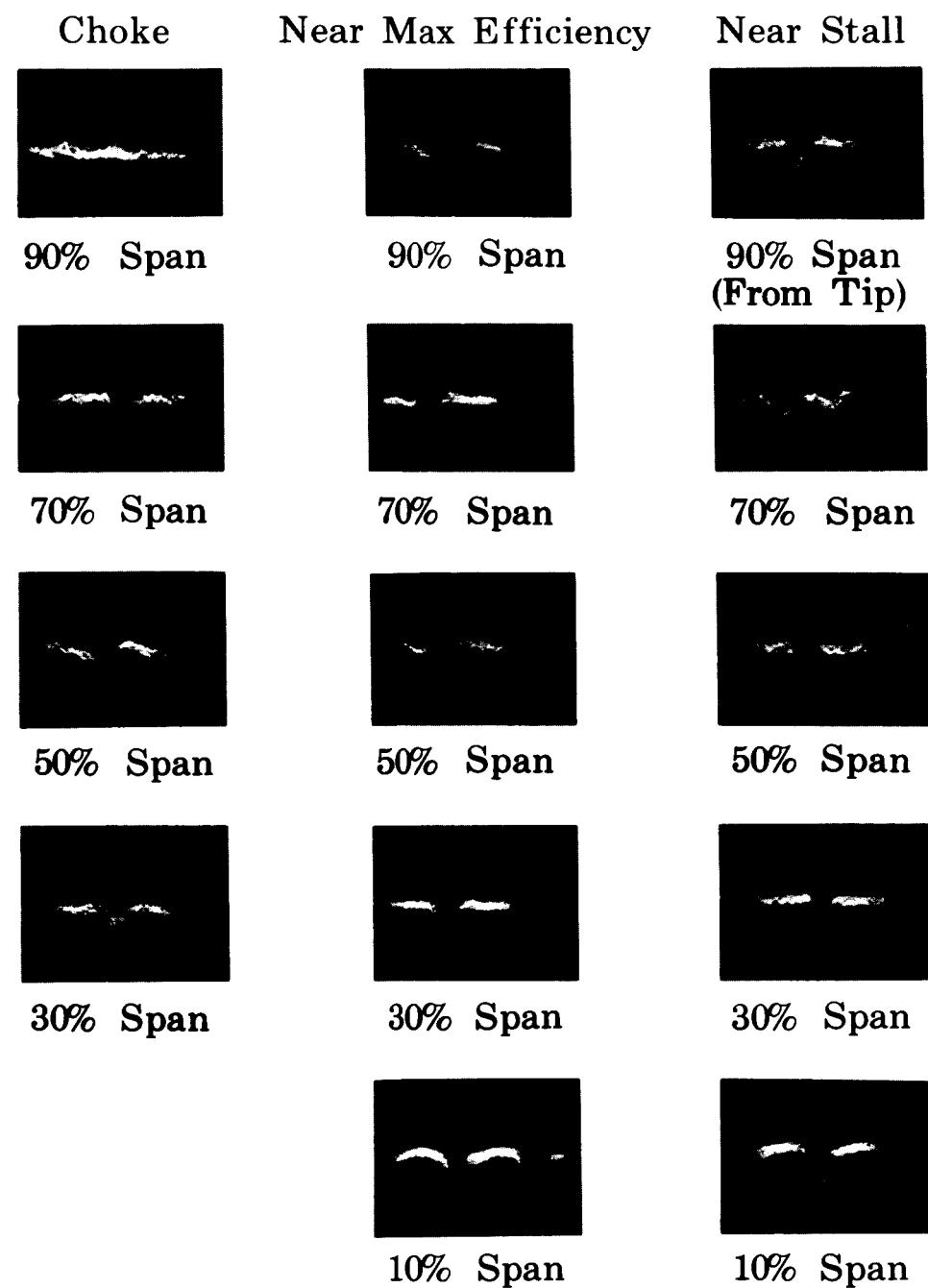


Figure V-24. Rotor Wake Surveys, 110% Design
Equivalent Rotor Speed

FD 18601A

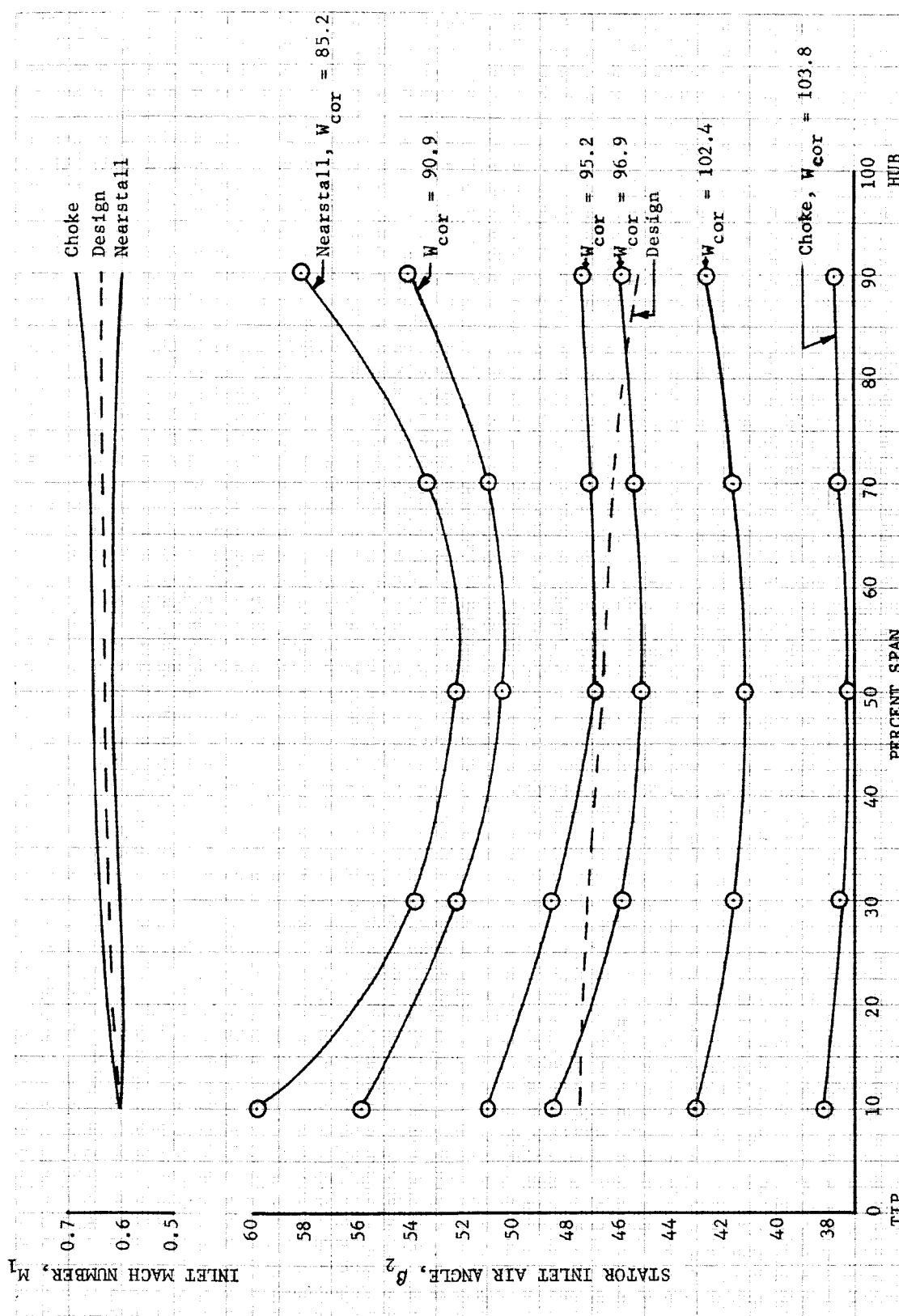


Figure V-25. Stator Inlet Air Angle and Mach Number Distribution, Slotted Rotor 1 Configuration, Design Rotor Speed
DF 52559

APPENDIX A
DEFINITION OF SYMBOLS

A. GENERAL NOMENCLATURE

A_A	Flow path annular area, in. ²
c	Chord length, in.
D	Diffusion factor
i_m	Incidence angle, deg
M	Absolute Mach number
o	Minimum blade passage gap, in.
o^*	Critical blade passage gap, in.
P	Total pressure, psia
p	Static pressure, psia
q	Pressure equivalent of the velocity head, psia
R	Reynolds number based on chord length
S	Blade spacing, in.
s	Blade span, in.
t	Blade maximum thickness, in.
U	Rotor speed, ft/sec
V	Absolute velocity, ft/sec
W	Actual flow rate, lb _m /sec
β	Absolute air angle, deg
γ	Ratio of specific heats
γ°	Blade-chord angle, deg
δ	Ratio of total pressure to NASA standard sea level pressure of 2116 psf
δ°	Deviation angle, deg
η_{ad}	Adiabatic efficiency
θ	Ratio of total temperature to NASA standard sea level temperature of 518.7°R

κ	Blade metal angle, deg
ρ	Density, lb_m/ft^3
σ	Solidity, c/S
ϕ	Blade camber angle, $\kappa_1 - \kappa_2$, deg
$\bar{\omega}$	Total pressure loss coefficient

Subscripts:

0	Guide vane inlet
1	Rotor inlet
2	Rotor exit; stator inlet
2A	Stator exit
z	Axial component
θ	Tangential component

Superscripts:

'	Related to rotor blade
-	Mass average value

B. SLOT NOMENCLATURE

A_2	Slot throat area, in. ²
R	Coanda radius, in.
R_p	Pressure surface edge radius, in.
r_1	Slot leading edge radius, in.
r_2	Slot trailing edge radius, in.
t	Blade thickness at intersection of slot centerline and mean camber line, in.
Y_1	Slot capture dimension, in.
Y_2	Slot throat dimension, in.
ψ	Angle formed by slot centerline and mean camber line, deg

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C. BLADE ELEMENT TABULATION NOMENCLATURE FOR TABLE B-2

PCT SPAN	Percent span
DIA	Diameter, inches
BETA	Absolute air angle, degrees
BETA(PR)	Relative air angle, degrees
V	Absolute velocity, ft/sec
VZ	Axial component of velocity, ft/sec
V-THETA	Tangential component of absolute velocity, ft/sec
V(PR)	Relative velocity, ft/sec
V-THETA PR	Tangential component of relative velocity, ft/sec
U	Wheel speed, ft/sec
M	Absolute Mach number
M(PR)	Relative Mach number
TURN	Air turning, degrees
TURN(PR)	Relative air turning, degrees
UUBAR	Loss coefficient
DFAC	Diffusion factor
EFFP	Polytropic efficiency
EFF	Adiabatic efficiency
INCID	Incidence, degrees
DEV	Deviation, degrees
LOSS PARA	Loss parameter

APPENDIX B
TABULATED PERFORMANCE

The overall performance and percent rotor and stator bleed flow rates for each test point are presented in table B-1.

Table B-2 presents blade element data for each test point. Definition of the blade element parameters as tabulated in the computer printouts is presented in Appendix A.

Table B-1. Tabulation of Overall Performance and Percent Bleed Flows

Corrected Weight Flow $\frac{W\sqrt{\theta}}{\delta}$		50% Design Equivalent Rotor Speed				70% Design Equivalent Rotor Speed			
lb _m /sec	\bar{P}_2/\bar{P}_1	Rotor η_{ad} Percent	Overall Performance \bar{P}_{2a}/\bar{P}_0	Stage \bar{P}_{2a}/\bar{P}_0	η_{ad} Percent	Rotor η_{ad} Percent	Overall Performance \bar{P}_{2a}/\bar{P}_0	Stage \bar{P}_{2a}/\bar{P}_0	η_{ad} Percent
43.39 (Near Stall)	1.08	81.3	1.07	72.0		1.82	3.92		
47.18	1.08	85.4	1.07	75.8		1.65	3.54		
51.80	1.07	93.1	1.06	78.7		1.52	3.15		
52.99	1.06	83.4	1.05	63.6		1.37	2.95		
60.46 (Choke)	1.04	91.1	1.03	65.1	1.18	2.48			
60.35 (Near Stall)	1.15	81.4	1.14	74.9		1.15	3.44		
62.36	1.15	88.5	1.13	79.9		1.05	3.18		
68.03	1.13	83.9	1.11	72.7		0.92	2.76		
72.59	1.11	86.8	1.09	76.0		0.83	2.46		
76.92	1.09	86.0	1.07	67.0		0.75	2.10		
79.88	1.07	79.0	1.05	54.1	0.78	0.78	2.03		

Table B-1. Tabulation of Overall Performance and Percent Bleed Flows (Continued)

90% Design Equivalent Rotor Speed		Overall Performance				Percent Bleed	
Corrected Weight Flow $\frac{W\sqrt{\theta}}{\delta}$	lb _m /sec	\bar{F}_2/\bar{F}_1	Rotor η_{ad} Percent	\bar{F}_{2a}/\bar{F}_0	Stage η_{ad} Percent	Rotor	Stator
81.69	(Near Stall)	1.26	90.4	1.23	79.6	1.56	3.87
83.67		1.25	90.9	1.22	78.8	1.49	3.71
88.80		1.22	91.6	1.18	77.3	1.36	3.32
92.37		1.19	91.2	1.15	74.0	1.24	2.99
95.47		1.16	89.8	1.12	69.9	1.11	2.61
98.10	(Choke)	1.12	85.8	1.08	55.6	1.06	2.34
100% Design Equivalent Rotor Speed							
85.19	(Near Stall)	1.35	87.4	1.30	77.0	1.62	3.94
90.88		1.33	93.4	1.28	79.8	1.49	3.60
95.25		1.29	90.5	1.25	78.5	1.35	3.27
96.88		1.25	92.0	1.20	75.3	1.13	2.79
102.39		1.19	84.8	1.17	75.2	1.15	2.67
103.78	(Choke)	1.14	77.5	1.09	54.1	0.76	1.73

Table B-1. Tabulation of Overall Performance and Percent Bleed Flows (Continued)

110% Design Equivalent Rotor Speed

$\frac{W\sqrt{\theta}}{\delta}$	lb _m /sec	\bar{P}_2/\bar{P}_1	Overall Performance			\bar{P}_{2a}/\bar{P}_0	η_{ad} Percent	Percent Bleed Rotor	Percent Bleed Stator
			Rotor	η_{ad} Percent	Stage				
94.90	(Near Stall)	1.43	85.5	1.35	64.5			1.58	3.79
99.49		1.38	88.6	1.33	78.2			1.45	3.48
103.66		1.32	86.9	1.28	75.6			1.31	3.16
107.61		1.25	84.7	1.21	70.2			1.12	2.69
108.82		1.22	82.1	1.16	60.8			0.96	2.30
109.75	(Choke)	1.16	72.3	1.11	48.1	0.76	0.76	1.90	

Table B-2. Blade Element Performance

Percent Design Speed = 50.61
Corrected Weight Flow = 43.39
Corrected Rotor Speed = 2828.20

INLET GUIDE VANE	STATION 0 - STATION 1					STATION 1 - STATION 2					SLOTTED ROTOR	ROTOR	1
	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30		
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501	36.372	26.933
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	25.613	26.495	26.855	26.855	26.495	26.933	26.355
BETA 1	25.613	26.495	26.855	26.933	26.372	BETA 2	57.614	53.266	52.737	54.403	52.737	54.403	62.635
V 0	178.31	178.31	178.31	178.31	178.31	BETA(PR) 1	61.475	62.492	63.872	64.732	66.461	66.461	66.461
V 1	198.39	200.47	199.52	201.60	196.39	BETA(PR) 2	34.734	37.062	39.655	43.683	50.880	50.880	50.880
VZ 0	178.31	178.31	178.31	178.31	178.31	V 1	198.39	199.52	199.52	201.60	196.39	196.39	196.39
VZ 1	178.90	179.42	178.00	179.74	179.95	V 2	340.92	345.32	347.75	342.73	335.41	335.41	335.41
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	178.90	179.42	178.00	179.74	175.95	175.95	175.95
V-THETA 1	85.76	89.43	90.13	91.32	87.24	VZ 2	182.61	206.54	210.56	199.50	154.17	154.17	154.17
M 0	0.1601	0.1601	0.1601	0.1601	0.1601	V-THETA 1	85.76	89.43	90.13	91.32	87.24	87.24	87.24
M 1	0.1783	0.1802	0.1793	0.1812	0.1765	V-THETA 2	287.90	276.75	276.75	278.69	297.88	297.88	297.88
TURN	-25.61	-26.49	-26.85	-26.93	-26.37	V(PR) 1	374.6	388.5	404.2	421.1	440.6	440.6	440.6
UUBAR	0.2263	0.1764	0.1611	0.1227	0.1573	V(PR) 2	222.2	258.8	273.3	275.9	244.4	244.4	244.4
DFAC	0.109	0.126	0.134	0.129	0.149	VTHETA PR1	-329.1	-344.5	-362.9	-380.8	-403.9	-403.9	-403.9
EFFP	0.5966	0.6878	0.7041	0.7904	0.6801	VTHETA PR2	-126.6	-156.6	-174.2	-190.5	-189.6	-189.6	-189.6
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	414.91	433.97	453.43	472.9	491.16	491.16	491.16
DEV	7.027	6.255	6.905	8.747	11.738	M 1	0.1783	0.1802	0.1793	0.1812	0.1765	0.1765	0.1765
						M 2	0.3628	0.3073	0.3098	0.3049	0.2975	0.2975	0.2975
						M(PR) 1	0.3366	0.3491	0.3632	0.3784	0.3959	0.3959	0.3959
						M(PR) 2	0.1973	0.2303	0.2434	0.2455	0.2168	0.2168	0.2168
						TURN(PR)	26.741	25.430	24.268	21.049	15.581	15.581	15.581
						UUBAR	0.1912	0.1107	0.1108	0.1135	0.2837	0.2837	0.2837
						DFAC	0.6223	0.5363	0.5277	0.5508	0.6762	0.6762	0.6762
						EFFP	0.6316	0.7261	0.7949	0.7512	0.6603	0.6603	0.6603
						EFF	0.6275	0.7229	0.7925	0.7482	0.6561	0.6561	0.6561
						INCID	9.79	8.88	8.89	9.22	10.34	10.34	10.34
STATION 2 - STATION 2A													
PCT SPAN	90	70	50	30	10								
BETA 2	57.614	53.266	52.737	54.403	62.635	DEV	12.294	8.162	5.765	5.543	8.890	8.890	8.890
BETA 2A	33.498	29.863	28.266	29.522	31.020	LOSS PARA	0.06316	0.03693	0.03715	0.05005	0.08357	0.08357	0.08357
V 2	340.92	345.32	347.75	342.73	335.41								
V 2A	209.16	204.93	230.22	235.03	234.23								
VZ 2	182.61	206.54	210.56	199.56	154.17								
VZ 2A	174.42	177.72	202.77	204.52	200.73								
V-THETA 2	287.90	276.75	276.76	278.69	297.88								
M 2	115.44	102.04	109.03	115.81	120.71								
M 2A	0.3628	0.3073	0.3098	0.3049	0.2975								
N 2A	0.1855	0.1819	0.2445	0.2087	0.2077								
TURN	24.116	23.403	24.471	24.881	31.615								
UUBAR	0.0944	0.1609	0.1992	0.0924	0.1062								
DFAC	0.3865	0.4066	0.3380	0.3142	0.3017								
EFFP	2.9759	1.9741	1.7093	1.9671	1.0991								
INCID	10.66	6.32	5.79	7.45	15.69								
DEV	16.56	12.92	11.33	12.58	14.08								
DIA	33.564	34.992	36.420	37.848	39.276								

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 50.70
 Corrected Weight Flow = 47.18
 Corrected Rotor Speed = 2833.33

INLET GUIDE VANE 1							SLOTTED ROTOR 1									
STATION 0 - STATION 1				STATION 1 - STATION 2				STATION 1 - STATION 1				STATION 1 - STATION 2				
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	PCT SPAN	90	70	50	30	
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	DIA	39.501	39.501	39.501	39.501	
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	25.724	26.486	25.677	26.915	BETA 1	25.508	25.508	25.508	25.508	
BETA 1	25.724	26.486	25.677	26.915	25.508	BETA 2	53.667	49.958	49.952	50.716	BETA 2	56.511	56.511	56.511	56.511	
V 0	194.36	194.36	194.36	194.36	194.36	BETA(PR) 1	58.077	59.529	61.192	62.574	BETA(PR) 1	64.715	64.715	64.715	64.715	
V 1	221.08	221.01	219.03	217.85	210.16	BETA(PR) 2	32.219	36.755	38.971	43.426	BETA(PR) 2	47.819	47.819	47.819	47.819	
VZ 0	194.36	194.36	194.36	194.36	194.36	V 1	221.08	221.01	219.03	217.85	V 1	210.16	210.16	210.16	210.16	
VZ 1	199.17	197.81	197.40	194.25	189.68	V 2	352.22	347.91	351.32	342.29	V 2	338.44	338.44	338.44	338.44	
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	199.17	197.81	197.40	194.25	VZ 1	189.68	189.68	189.68	189.68	
V-THETA 1	95.96	98.56	94.90	98.61	90.50	VZ 2	208.68	223.83	226.05	216.72	VZ 2	186.74	186.74	186.74	186.74	
M 0	0.1746	0.1746	0.1746	0.1746	0.1746	V-THETA 1	95.96	98.56	94.90	98.61	V-THETA 1	90.50	90.50	90.50	90.50	
M 1	0.1988	0.1988	0.1970	0.1959	0.1889	V-THETA 2	283.74	266.35	268.94	264.94	V-THETA 2	282.26	282.26	282.26	282.26	
TURN	-25.72	-26.49	-25.68	-26.91	-25.51	V(PR) 1	376.7	390.1	409.6	421.7	V(PR) 1	444.1	444.1	444.1	444.1	
UUBAR	0.1745	0.1422	0.1390	0.1196	0.1745	V(PR) 2	246.7	279.4	290.8	298.4	V(PR) 2	278.1	278.1	278.1	278.1	
DFAC	0.095	0.116	0.118	0.136	0.157	VTHETA PR1	-319.7	-336.2	-358.9	-374.3	VTHETA PR1	-401.5	-401.5	-401.5	-401.5	
EFFP	0.6982	0.7491	0.7408	0.7692	0.5881	VTHETA PR2	-131.5	-167.2	-182.9	-205.1	VTHETA PR2	-206.1	-206.1	-206.1	-206.1	
INCID	0.00000	0.00000	0.00000	0.00000	0.00000	U 1	415.66	434.76	453.85	472.95	U 1	492.05	492.05	492.05	492.05	
DEV	6.916	6.264	8.083	8.765	12.602	U 2	415.25	433.52	451.80	470.07	U 2	488.34	488.34	488.34	488.34	
STATOR 1							M 1	0.1988	0.1988	0.1970	0.1959	M 1	0.1889	0.1889	0.1889	0.1889
STATION 2 - STATION 2A							M 2	0.3130	0.3099	0.3130	0.3049	M 2	0.3006	0.3006	0.3006	0.3006
STATION 2 - STATION 2A							M(PR) 1	0.3387	0.3508	0.3684	0.3792	M(PR) 1	0.392	0.392	0.392	0.392
STATION 2 - STATION 2A							M(PR) 2	0.2192	0.2489	0.2591	0.2658	M(PR) 2	0.2470	0.2470	0.2470	0.2470
STATION 2 - STATION 2A							TURN(PR)	25.858	22.773	22.221	19.148	TURN(PR)	16.897	16.897	16.897	16.897
STATION 2 - STATION 2A							UUBAR	0.1464	0.0688	0.1025	0.1084	UUBAR	0.2361	0.2361	0.2361	0.2361
STATION 2 - STATION 2A							DFAC	0.5442	0.4648	0.4780	0.4755	DFAC	0.5829	0.5829	0.5829	0.5829
STATION 2 - STATION 2A							EFFP	0.6032	0.7184	0.7487	0.7473	EFFP	0.6581	0.6581	0.6581	0.6581
STATION 2 - STATION 2A							EFF	0.5990	0.7153	0.7458	0.7445	EFF	0.6442	0.6442	0.6442	0.6442
STATION 2 - STATION 2A							INCID	6.39	5.92	6.21	7.06	INCID	8.60	8.60	8.60	8.60
STATION 2 - STATION 2A							DEV	9.779	7.855	5.131	5.286	DEV	5.829	5.829	5.829	5.829
STATION 2 - STATION 2A							LOSS PARA	0.04954	0.02304	0.03455	0.03550	LOSS PARA	0.07401	0.07401	0.07401	0.07401
STATION 2 - STATION 2A							B-6					B-6				

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Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 49.85
 Corrected Weight Flow = 52.99
 Corrected Rotor Speed = 2785.50

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 49.90
Corrected Weight Flow = 60.46
Corrected Rotor Speed = 2788.20

INLET GUIDE VANE 1						STATION 1 - STATION 2					
STATION 1 - STATION 1						STATION 1 - STATION 2					
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501
BETA 1	0.000	0.000	0.000	0.000	0.000	BETA 1	25.861	26.765	25.080	26.932	30.413
BETA 1	25.861	26.765	25.080	26.932	30.413	BETA 2	37.119	36.886	36.509	36.503	37.224
V 1	251.55	251.55	251.55	251.55	251.55	BETA(PR) 1	46.683	48.008	50.343	51.601	53.748
V 1	294.16	296.65	294.51	294.97	287.83	BETA(PR) 2	29.045	33.552	36.864	41.662	45.801
VZ L	251.55	251.55	251.55	251.55	251.55	V 1	294.16	296.65	294.51	294.97	287.83
VZ 1	264.70	24.86	266.74	262.98	248.22	V 2	390.56	377.32	371.23	353.09	337.52
V-THETA 1	-0.50	-0.50	-0.00	-0.50	-0.50	VZ 1	264.86	264.86	266.74	262.98	248.22
V-THETA 1	128.31	133.59	124.84	133.60	145.71	VZ 2	311.43	301.79	298.38	283.82	268.76
M 1	0.2265	0.2265	0.2265	0.2265	0.2265	V-THETA 1	128.31	133.59	124.84	133.60	145.71
M 1	0.2654	0.2676	0.2657	0.2661	0.2596	V-THETA 2	235.69	226.47	220.86	210.04	204.18
TURN	-25.86	-26.76	-25.08	-26.93	-30.41	V(PR) 1	385.8	395.9	418.0	423.4	419.8
UUBAR	0.1571	0.1028	0.10n9	0.0679	0.1047	V(PR) 2	356.2	362.1	372.9	379.9	385.5
DFAC	0.571	0.386	0.378	0.396	0.153	VTHETA PR1	-280.7	-294.2	-321.8	-331.8	-338.5
EFFP	0.7413	0.8338	0.8300	0.8924	0.7970	VTHETA PR2	-172.9	-200.1	-223.7	-252.5	-276.4
INCID	0.0600	0.0000	0.0000	0.0000	0.0000	U 1	409.04	427.84	446.62	465.42	484.21
DEV	6.779	5.985	8.680	8.748	7.697	U 2	408.64	426.62	444.60	462.58	480.56
STATOR 1											
STATION 2 - STATION 2A											
PCT SPAN	90	70	50	30	10	M 1	0.2654	0.2676	0.2657	0.2661	0.2596
BETA 2	37.119	36.886	36.509	36.5j3	37.224	M 2	0.3508	0.3390	0.3169	0.3028	0.3785
BETA 2A	24.764	24.594	21.932	23.927	26.692	M(PR) 1	0.3481	0.3572	0.3770	0.3819	0.3459
V 2	390.56	377.32	371.23	353.59	337.52	M(PR) 2	0.3200	0.3254	0.3353	0.3410	0.3459
V 2A	301.33	295.56	292.35	281.82	258.96	TURN(PR)	17.639	14.456	13.479	9.939	7.947
VZ 2	311.43	301.79	298.38	283.82	268.76	UUBAR	0.0000	0.0154	0.0615	0.0439	-0.0171
VZ 2A	273.62	270.86	271.20	257.61	231.36	DFAC	0.1882	0.1849	0.2107	0.1892	0.1537
V-THETA 2	235.69	226.47	220.86	210.44	204.18	EFFP	0.7399	0.7422	0.8257	0.6439	0.6606
V-THETA 2A	126.22	118.30	119.20	114.30	116.32	EFF	0.7381	0.7406	0.8246	0.6420	0.6589
M 2	0.3508	0.3390	0.3338	0.3169	0.3028	INCID	-5.01	-5.60	-4.64	-3.91	-2.37
M 2A	0.2698	0.2651	0.2623	0.2527	0.2318	DEV	4.605	4.652	3.024	3.522	3.811
TURN	12.355	13.292	14.577	12.576	10.532	DIA	0.0000	0.00536	0.02041	0.01479	-0.05556
UUBAR	0.1478	0.1232	0.1235	0.1018	0.1638						
DFAC	0.2285	0.2167	0.2125	0.2018	0.2328						
EFFP	1.0279	1.6862	1.3486	3.1217	1.0414						
INCID	-9.83	-10.06	-10.44	-10.45	-9.73						
DEV	7.82	6.65	4.99	6.99	9.75						
DIA	33.564	34.992	36.420	37.848	39.276						

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 70.22
Corrected Weight Flow = 60.35
Corrected Rotor Speed = 3923.98

INLET GLICE VANE		STATION 0 - STATION 1				STATION 1 - STATION 2				SLOTTED ROTOR		
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.8C1	DIA	33.589	35.067	36.545	38.023	39.501	
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	27.692	27.912	27.907	28.126	27.338	
BETA 1	27.692	27.912	27.907	28.126	27.338	BETA 2	55.429	51.416	50.795	53.395	61.246	
V 0	251.35	251.05	251.05	251.05	251.05	BETA(PR) 1	59.170	60.485	62.050	63.436	65.187	
V 1	295.47	296.75	294.60	293.03	286.25	BETA(PR) 2	33.000	36.133	38.008	42.620	49.723	
VZ 0	251.05	251.05	251.05	251.05	251.05	V 1	295.47	296.75	294.60	293.03	286.25	
VZ 1	261.62	262.23	260.34	258.42	254.28	V 2	482.50	485.36	493.12	481.71	468.24	
V-THETA 0	-3.00	-0.00	-0.00	-C.00	-0.00	VZ 1	261.62	262.23	260.34	258.42	254.28	
V-THETA 1	137.31	138.91	137.88	138.14	131.46	VZ 2	273.78	302.7C	311.70	287.24	225.25	
M 0	0.2260	0.2260	0.2260	0.2260	0.2260	V-THETA 1	137.31	138.91	137.88	138.14	131.46	
M 1	C.2665	0.2677	0.2658	0.2643	0.2581	V-THETA 2	397.30	379.4C	382.11	386.7C	410.50	
TURN	-27.69	-27.91	-27.91	-28.13	-27.34	V(PR) 1	510.5	532.3	555.5	577.9	605.9	
UUBAR	0.1e16	0.1227	0.1188	0.1052	0.1402	V(PR) 2	326.4	374.8	395.6	390.3	348.4	
DFAC	0.080	0.094	0.102	0.111	0.126	VTHETA FR1	-438.4	-463.2	-490.7	-516.9	-550.0	
EFFF	0.7438	0.8046	0.8028	0.6196	0.7296	VTHETA FR2	-177.8	-221.0	-243.6	-264.3	-265.8	
INCID	0.0C00	0.00000	0.00000	0.00000	0.00000	U 1	575.66	602.12	628.55	655.00	681.46	
DEV	4.948	4.828	5.853	7.554	10.7i2	U 2	575.10	600.40	625.71	651.01	676.32	
						M 1	0.2665	0.2677	0.2658	0.2643	0.2581	
						M 2	0.4213	0.4249	0.4222	0.4214	0.4077	
						M(PR) 1	0.4605	0.4802	0.5011	0.5212	0.5464	
						M(PR) 2	0.2850	0.3281	0.3467	0.3414	0.3034	
						TURN(PR)	26.170	24.3552	24.043	20.616	15.464	
						UUBAR	0.1368	0.0672	0.0745	0.1286	0.2762	
						DFAC	0.5639	0.4859	0.4820	0.5238	0.6476	
						EFFF	0.4737	0.518C	0.5540	0.5348	0.4958	
						EFF	0.4630	0.507E	0.5440	0.5245	0.4846	
						INCID	7.48	6.87	7.07	7.93	9.07	
PCT SPAN		90	70	50	30	10						
BETA 2	55.429	51.416	50.795	53.395	61.246	DEV	10.560	7.233	4.168	4.480	7.733	
BETA 2A	30.165	28.875	27.982	29.000	32.448	LOSS PARA	0.04589	0.02272	0.02554	0.04598	0.08336	
V 2	482.50	485.26	493.12	481.71	468.24							
V 2A	289.57	291.12	322.09	324.02	299.62							
V 2	273.78	302.70	311.70	287.24	225.25							
V 2A	250.35	254.92	284.43	283.40	252.34							
V-THETA 2	397.30	379.40	382.11	386.70	410.50							
V-THETA 2A	145.50	140.58	151.12	157.09	160.43							
M 2	0.4212	0.4249	0.4322	0.4214	0.4C77							
M 2A	0.2544	0.2563	0.2638	0.2855	0.2626							
TURN	25.264	22.541	22.813	24.395	2E.798							
UUBAR	0.1151	0.1495	0.1199	0.1044	0.1781							
DFAC	0.3999	0.4002	0.3468	0.3274	0.3C14							
EFFF	1.4750	-1.5536	-1.4990	-1.0288	-0.7844							
INCID	8.48	4.47	3.85	6.45	14.30							
DEV	13.23	11.93	11.04	12.06	15.51							
DIA	33.564	34.992	36.420	37.848	39.276							

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 69.01
 Corrected Weight Flow = 62.36
 Corrected Rotor Speed = 3856.16

INLET GUIDE VANE 1						SLOTTED ROTOR 1					
STATION 0 - STATION 1			STATION 1 - STATION 2			STATION 1 - STATION 2			STATION 1 - STATION 2		
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.561
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	26.359	26.962	27.386	26.736	26.919
BETA 1	26.359	26.962	27.386	26.730	26.919	BETA 2	52.562	49.749	49.545	51.618	57.594
V 0	259.86	259.86	259.86	259.86	259.86	BETA(PR) 1	56.853	58.305	59.946	61.334	63.182
V 1	311.51	311.95	309.68	308.95	302.13	BETA(PR) 2	32.343	35.188	37.561	42.011	47.801
VZ 0	259.86	259.86	259.86	259.86	259.86	V 1	311.51	311.95	309.66	308.95	302.13
VZ 1	279.12	278.04	274.98	275.94	269.40	V 2	479.37	484.10	488.05	476.31	465.05
V-THETA C	-0.60	-0.00	-0.00	-0.00	-0.00	VZ 1	279.12	278.04	274.98	275.94	269.40
V-THETA I	138.31	141.44	142.45	138.96	136.79	VZ 2	291.41	312.79	316.67	295.74	248.16
M 0	0.2340	0.2340	0.2340	0.2340	0.2340	V-THETA 1	138.31	141.44	142.45	138.96	136.79
M 1	0.2812	0.2812	0.2812	0.2796	0.2789	V-THETA 2	380.63	369.47	373.37	373.37	390.94
TURN	-26.36	-26.96	-27.39	-26.73	-26.92	V(PR) 1	510.5	529.2	549.1	575.2	597.1
UUBAR	0.1510	0.1219	0.1182	0.0982	0.1346	V(PR) 2	344.9	382.7	399.5	396.0	369.4
DFAC	0.047	0.072	0.082	0.082	0.0107	VTHETA PR1	-1427.4	-450.3	-475.2	-504.7	-522.4
EFFP	0.7780	0.8191	0.8175	0.8465	0.7645	VTHETA PR2	-184.5	-220.6	-243.5	-266.4	-273.7
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	565.71	591.71	617.69	643.66	669.68
DEV	6.281	5.788	6.374	8.950	11.191	U 2	565.16	590.03	614.89	639.76	664.63
						M 1	0.2812	0.2816	0.2796	0.2739	0.2726
						M 2	0.4250	0.4311	0.4350	0.4238	0.4102
						M(PR) 1	0.4609	0.4778	0.4957	0.5193	0.5388
						M(PR) 2	0.3058	0.3409	0.3561	0.3541	0.3273
						TURN(PR)	24.510	23.117	22.385	19.323	15.380
						UUBAR	0.1026	0.0481	0.2576	0.1285	0.2228
						DFAC	0.5139	0.4580	0.4568	0.4970	0.5875
						EFFP	0.6903	0.8411	0.8907	0.8471	0.7566
						EFF	0.6843	0.8378	0.8884	0.8440	0.7115
						INCIC	5.16	4.70	4.97	5.02	5.66
						PCT SPAN	90	70	50	30	10
BETA 2	52.562	49.749	49.545	51.618	57.594		9.903	6.288	3.721	3.871	5.811
BETA 2A	29.500	28.000	27.500	27.500	32.000		0.03467	0.01643	0.01987	0.04305	0.06386
V 2	479.37	484.10	488.05	476.31	463.05						
V 2A	288.70	308.26	320.73	323.31	320.18	DEV					
VZ 2	291.41	312.79	316.67	295.74	248.16	LOSS PARA					
VZ 2A	251.27	272.18	284.49	286.78	271.53						
V-THETA 2	386.63	369.47	371.37	373.37	390.94						
V-THETA 2A	142.16	144.72	148.10	149.29	169.67						
M 2	0.4250	0.4311	0.4350	0.4238	0.4102						
M 2A	0.2543	0.2724	0.2836	0.2856	0.2823						
TURN	23.662	21.749	22.045	24.118	25.594						
UUBAR	0.1197	0.1094	0.1133	0.0910	0.1075						
DFAC	0.3978	0.3632	0.3428	0.3212	0.3085						
EFFP	1.4647	1.1764	1.0945	1.1307	1.1512						
INCIC	5.61	2.80	2.60	4.67	10.64						
DEV	12.56	11.06	10.56	10.56	15.06						
DIA	33.564	34.992	36.420	37.848	39.276						

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 70.54
 Corrected Weight Flow = 68.03
 Corrected Rotor Speed = 3941.75

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 70.54
Corrected Weight Flow = 72.59
Corrected Rotor Speed = 3941.75

INLET GLIDE VANE 1							STATION 0 - STATION 1							STATION 1 - STATION 2																																																																																																																																																																																																																																																																																																																																																																																																																																												
			PCT SPAN			90			70			50			30			10			PCT SPAN			90			70			50			30																																																																																																																																																																																																																																																																																																																																																																																																																									
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.569	35.067	36.545	38.022	39.5C1	BETA 1	26.500	26.500	26.500	26.500	26.500	27.000	27.000	27.000	27.000	27.000	BETA 2	43.065	42.382	42.108	43.135	45.673	45.673																																																																																																																																																																																																																																																																																																																																																																																																																													
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	51.094	52.627	54.311	56.071	58.226	BETA(PR) 1	305.54	305.54	305.54	305.54	305.54	42.108	42.108	42.108	43.135	45.673	BETA(PR) 2	33.027	34.834	37.986	42.277	47.9C7	47.9C7																																																																																																																																																																																																																																																																																																																																																																																																																													
BETA 1	26.500	26.500	26.500	26.500	26.500	BETA 2	369.96	361.85	371.69	373.85	373.85	BETA(PR) 1	361.85	361.85	361.85	361.85	361.85	369.96	369.96	369.96	371.69	373.85	BETA(PR) 2	371.69	373.85	373.85	373.85	373.85	373.85																																																																																																																																																																																																																																																																																																																																																																																																																													
V 0	305.54	305.54	305.54	305.54	305.54	V 1	305.54	305.54	305.54	305.54	305.54	V 2	323.87	323.87	323.87	323.87	323.87	498.98	507.62	502.87	485.43	456.30	V 3	329.63	329.63	329.63	329.63	329.63	329.63																																																																																																																																																																																																																																																																																																																																																																																																																													
V 1	371.86	373.85	371.69	371.69	371.69	V 2	-0.00	-0.00	-0.00	-0.00	-0.00	V 3	332.79	332.79	332.79	332.79	332.79	328.18	328.18	328.18	329.63	329.63	V 4	361.85	361.85	361.85	361.85	361.85	361.85																																																																																																																																																																																																																																																																																																																																																																																																																													
V 2	305.54	305.54	305.54	305.54	305.54	V 3	174.50	161.47	V 4	161.47	161.47	V 5	364.54	364.54	364.54	364.54	364.54	373.07	373.07	373.07	373.07	373.07	V 6	373.85	373.85	373.85	373.85	373.85	373.85																																																																																																																																																																																																																																																																																																																																																																																																																													
V 3	332.79	324.57	328.18	328.18	328.18	V 4	-0.00	-0.00	V 5	167.96	167.96	V 6	374.97	374.97	374.97	374.97	374.97	371.69	371.69	371.69	371.69	371.69	V 7	369.96	369.96	369.96	369.96	369.96	369.96																																																																																																																																																																																																																																																																																																																																																																																																																													
V 4	-0.00	-0.00	-0.00	-0.00	-0.00	V 5	166.81	166.81	V 6	166.81	166.81	V 7	174.50	174.50	174.50	174.50	174.50	167.96	167.96	167.96	167.96	167.96	V 8	161.47	161.47	161.47	161.47	161.47	161.47																																																																																																																																																																																																																																																																																																																																																																																																																													
V 5	165.92	166.81	166.81	166.81	166.81	V 6	167.96	167.96	V 7	167.96	167.96	V 8	174.50	174.50	174.50	174.50	174.50	171.90	171.90	171.90	171.90	171.90	V 9	166.81	166.81	166.81	166.81	166.81	166.81																																																																																																																																																																																																																																																																																																																																																																																																																													
V 6	0.2757	0.2757	0.2757	0.2757	0.2757	V 7	0.2757	0.2757	V 8	0.2757	0.2757	V 9	0.3276	0.3276	V 10	0.3276	0.3276	342.18	342.18	342.18	337.19	337.19	V 11	326.42	326.42	326.42	326.42	326.42	326.42																																																																																																																																																																																																																																																																																																																																																																																																																													
V 7	0.3239	0.32387	0.32387	0.32387	0.32387	V 8	0.3367	0.3367	V 9	0.3351	0.3351	V 10	-26.50	-26.50	V 11	-26.50	-26.50	529.9	551.2	562.5	562.5	562.5	V 12	590.6	590.6	590.6	590.6	590.6	590.6																																																																																																																																																																																																																																																																																																																																																																																																																													
TURN	-26.50	-26.50	-26.50	-26.50	-26.50	V 11	0.0966	0.0966	V 12	0.0971	0.0971	V 13	0.1073	0.1073	V 14	0.1073	0.1073	434.8	456.8	473.4	473.4	473.4	V 15	478.8	478.8	478.8	478.8	478.8	478.8																																																																																																																																																																																																																																																																																																																																																																																																																													
UUBAR	0.1402	0.0966	0.0966	0.0966	0.0966	V 13	0.0873	0.0873	V 14	0.0970	0.0970	V 15	0.0970	0.0970	V 16	-438.3	-438.3	-438.3	-438.3	-438.3	V 17	-456.9	-456.9	-456.9	-456.9	-456.9	-456.9																																																																																																																																																																																																																																																																																																																																																																																																																															
DFAC	0.049	0.049	0.049	0.049	0.049	V 15	0.068	0.068	V 16	0.0826	0.0826	V 17	0.0826	0.0826	V 18	-237.0	-260.5	-291.4	-291.4	-322.1	V 19	-353.0	-353.0	-353.0	-353.0	-353.0	-353.0																																																																																																																																																																																																																																																																																																																																																																																																																															
EFFP	0.8C08	0.8636	0.8636	0.8636	0.8636	V 17	0.0000	0.0000	V 18	0.0000	0.0000	V 19	0.0000	0.0000	V 20	57.8	604.84	631.40	657.97	684.54	V 21	615.2	615.2	615.2	615.2	615.2	615.2																																																																																																																																																																																																																																																																																																																																																																																																																															
INCIC	0.0000	0.0000	0.0000	0.0000	0.0000	V 20	0.0000	0.0000	V 21	0.0000	0.0000	V 22	0.0000	0.0000	V 23	57.7	603.12	628.54	653.96	679.38	V 24	697.0	697.0	697.0	697.0	697.0	697.0																																																																																																																																																																																																																																																																																																																																																																																																																															
DEV	6.140	6.250	5.760	5.760	5.760	V 22	8.680	11.610	V 23	8.680	11.610	V 24	0.3369	0.3369	V 25	0.3387	0.3387	0.3367	0.3367	0.3367	V 26	0.4562	0.4562	0.4562	0.4562	0.4562	0.4562																																																																																																																																																																																																																																																																																																																																																																																																																															
						STATOR	1					M(PR) 1	0.48C0	0.4994	M(PR) 2	0.3898	0.4106	M(PR) 3	0.4250	0.4250	M(PR) 4	0.4250	0.4250	M(PR) 5	0.4250	0.4250	M(PR) 6	0.4250	0.4250	M(PR) 7	0.4250	0.4250	M(PR) 8	0.4250	0.4250	M(PR) 9	0.4250	0.4250	M(PR) 10	0.4250	0.4250	M(PR) 11	0.4250	0.4250	M(PR) 12	0.4250	0.4250	M(PR) 13	0.4250	0.4250	M(PR) 14	0.4250	0.4250	M(PR) 15	0.4250	0.4250	M(PR) 16	0.4250	0.4250	M(PR) 17	0.4250	0.4250	M(PR) 18	0.4250	0.4250	M(PR) 19	0.4250	0.4250	M(PR) 20	0.4250	0.4250	M(PR) 21	0.4250	0.4250	M(PR) 22	0.4250	0.4250	M(PR) 23	0.4250	0.4250	M(PR) 24	0.4250	0.4250	M(PR) 25	0.4250	0.4250	M(PR) 26	0.4250	0.4250	M(PR) 27	0.4250	0.4250	M(PR) 28	0.4250	0.4250	M(PR) 29	0.4250	0.4250	M(PR) 30	0.4250	0.4250	M(PR) 31	0.4250	0.4250	M(PR) 32	0.4250	0.4250	M(PR) 33	0.4250	0.4250	M(PR) 34	0.4250	0.4250	M(PR) 35	0.4250	0.4250	M(PR) 36	0.4250	0.4250	M(PR) 37	0.4250	0.4250	M(PR) 38	0.4250	0.4250	M(PR) 39	0.4250	0.4250	M(PR) 40	0.4250	0.4250	M(PR) 41	0.4250	0.4250	M(PR) 42	0.4250	0.4250	M(PR) 43	0.4250	0.4250	M(PR) 44	0.4250	0.4250	M(PR) 45	0.4250	0.4250	M(PR) 46	0.4250	0.4250	M(PR) 47	0.4250	0.4250	M(PR) 48	0.4250	0.4250	M(PR) 49	0.4250	0.4250	M(PR) 50	0.4250	0.4250	M(PR) 51	0.4250	0.4250	M(PR) 52	0.4250	0.4250	M(PR) 53	0.4250	0.4250	M(PR) 54	0.4250	0.4250	M(PR) 55	0.4250	0.4250	M(PR) 56	0.4250	0.4250	M(PR) 57	0.4250	0.4250	M(PR) 58	0.4250	0.4250	M(PR) 59	0.4250	0.4250	M(PR) 60	0.4250	0.4250	M(PR) 61	0.4250	0.4250	M(PR) 62	0.4250	0.4250	M(PR) 63	0.4250	0.4250	M(PR) 64	0.4250	0.4250	M(PR) 65	0.4250	0.4250	M(PR) 66	0.4250	0.4250	M(PR) 67	0.4250	0.4250	M(PR) 68	0.4250	0.4250	M(PR) 69	0.4250	0.4250	M(PR) 70	0.4250	0.4250	M(PR) 71	0.4250	0.4250	M(PR) 72	0.4250	0.4250	M(PR) 73	0.4250	0.4250	M(PR) 74	0.4250	0.4250	M(PR) 75	0.4250	0.4250	M(PR) 76	0.4250	0.4250	M(PR) 77	0.4250	0.4250	M(PR) 78	0.4250	0.4250	M(PR) 79	0.4250	0.4250	M(PR) 80	0.4250	0.4250	M(PR) 81	0.4250	0.4250	M(PR) 82	0.4250	0.4250	M(PR) 83	0.4250	0.4250	M(PR) 84	0.4250	0.4250	M(PR) 85	0.4250	0.4250	M(PR) 86	0.4250	0.4250	M(PR) 87	0.4250	0.4250	M(PR) 88	0.4250	0.4250	M(PR) 89	0.4250	0.4250	M(PR) 90	0.4250	0.4250	M(PR) 91	0.4250	0.4250	M(PR) 92	0.4250	0.4250	M(PR) 93	0.4250	0.4250	M(PR) 94	0.4250	0.4250	M(PR) 95	0.4250	0.4250	M(PR) 96	0.4250	0.4250	M(PR) 97	0.4250	0.4250	M(PR) 98	0.4250	0.4250	M(PR) 99	0.4250	0.4250	M(PR) 100	0.4250	0.4250	M(PR) 101	0.4250	0.4250	M(PR) 102	0.4250	0.4250	M(PR) 103	0.4250	0.4250	M(PR) 104	0.4250	0.4250	M(PR) 105	0.4250	0.4250	M(PR) 106	0.4250	0.4250	M(PR) 107	0.4250	0.4250	M(PR) 108	0.4250	0.4250	M(PR) 109	0.4250	0.4250	M(PR) 110	0.4250	0.4250	M(PR) 111	0.4250	0.4250	M(PR) 112	0.4250	0.4250	M(PR) 113	0.4250	0.4250	M(PR) 114	0.4250	0.4250	M(PR) 115	0.4250	0.4250	M(PR) 116	0.4250	0.4250	M(PR) 117	0.4250	0.4250	M(PR) 118	0.4250	0.4250	M(PR) 119	0.4250	0.4250	M(PR) 120	0.4250	0.4250	M(PR) 121	0.4250	0.4250	M(PR) 122	0.4250	0.4250	M(PR) 123	0.4250	0.4250	M(PR) 124	0.4250	0.4250	M(PR) 125	0.4250	0.4250	M(PR) 126	0.4250	0.4250	M(PR) 127	0.4250	0.4250	M(PR) 128	0.4250	0.4250	M(PR) 129	0.4250	0.4250	M(PR) 130	0.4250	0.4250	M(PR) 131	0.4250	0.4250	M(PR) 132	0.4250	0.4250	M(PR) 133	0.4250	0.4250	M(PR) 134	0.4250	0.4250	M(PR) 135	0.4250	0.4250	M(PR) 136	0.4250	0.4250	M(PR) 137	0.4250	0.4250	M(PR) 138	0.4250	0.4250	M(PR) 139	0.4250	0.4250	M(PR) 140	0.4250	0.4250	M(PR) 141	0.4250	0.4250	M(PR) 142	0.4250	0.4250	M(PR) 143	0.4250	0.4250	M(PR) 144	0.42

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 70.06
Corrected Weight Flow = 76.92
Corrected Rotor Speed = 3915.18

INLET GUIDE VANE 1		STATION 0 - STATION 1				STATION 1 - STATION 2				SLOTTED ROTOR 1		
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	33.672	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501	
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	28.461	28.553	28.865	28.977	26.831	
BETA 1	28.461	28.553	28.865	28.977	26.831	BETA 2	39.004	38.951	38.324	39.616	41.231	
V 2	325.39	325.39	325.39	325.39	325.39	BETA(PR) 1	47.394	49.110	51.215	53.036	55.569	
V 1	400.98	402.56	398.90	396.83	387.85	BETA(PR) 2	31.382	35.168	38.244	41.991	46.533	
V 0	325.39	325.39	325.39	325.39	325.39	V 1	400.98	402.56	398.80	396.83	387.85	
V 1	352.52	353.60	349.26	347.15	346.10	V 2	520.05	509.14	504.10	488.01	464.57	
V-TTHETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	352.52	353.60	349.26	347.15	346.10	
V-TTHETA 1	191.09	192.41	192.52	192.25	175.06	VZ 2	404.13	395.95	395.48	375.93	349.39	
M 0	0.2940	0.2940	0.2940	0.2940	0.2940	V-THETA 1	191.09	192.41	192.52	192.25	175.06	
M 1	0.3639	0.3654	0.3619	0.3600	0.3517	V-THETA 2	327.30	320.07	312.60	311.18	306.20	
TURN	-28.46	-28.55	-28.86	-28.98	-26.83	V(PRI) 1	520.7	540.2	557.6	577.3	612.1	
UIBAR	0.1309	0.0877	0.0853	0.0701	0.1076	V(PRI) 2	473.4	484.4	503.6	505.8	507.9	
DFAC	0.044	0.058	0.071	0.080	0.084	VTHETA PRI	-383.3	-408.4	-434.6	-461.3	-504.9	
EFFP	0.9219	0.8811	0.8787	0.8986	0.8239	VTHETA PR2	-246.5	-279.0	-311.7	-338.4	-368.6	
INC1D	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	574.37	600.76	627.14	653.53	679.93	
DEV	4.179	4.197	4.895	6.703	11.279	U 2	573.81	599.06	624.31	649.55	674.80	
						M 1	0.3639	0.3654	0.3600	0.3517	0.3517	
STATOR 1						M 2	0.4689	0.4590	0.4547	0.4398	0.4172	
						M(PR) 1	0.4726	0.4903	0.5059	0.5238	0.5551	
						M(PR) 2	0.4268	0.4367	0.4542	0.4558	0.4561	
						TURN(PR)	16.012	13.942	12.971	11.046	9.036	
						UUBAR	0.0613	-0.0310	-0.0419	0.0121	0.1027	
						DFAC	0.1957	0.2037	0.1938	0.2220	0.2774	
						EFFP	0.9075	0.9041	0.9797	0.9410	0.8001	
						INCIDM	0.9062	0.9028	0.9794	0.9403	0.7978	
						-4.30	-4.50	-3.76	-2.47	-0.55		
						STATION 2 - STATION 2A						
PCT SPAN	90	70	50	30	10							
BFTA 2	39.004	39.951	38.324	39.616	41.231							
BETA 2A	25.600	24.600	23.000	25.500	28.700							
V 2	520.05	509.14	504.10	488.01	464.57							
V 2A	386.65	385.91	383.34	376.21	344.34							
V 2	404.13	395.95	395.48	375.93	349.39							
V 2A	348.70	350.89	352.96	339.57	302.03							
V-TTHETA 2	327.30	320.07	312.60	311.18	306.20							
V-TTHETA 2A	167.07	160.65	149.78	161.96	165.36							
M 2	0.4689	0.4590	0.4547	0.4398	0.4172							
M 2A	0.3443	0.3452	0.3429	0.3365	0.3071							
TURN	13.404	14.351	15.324	14.116	12.531							
UIBAR	0.1257	0.1008	0.1128	0.0988	0.1539							
DFAC	0.2565	0.2420	0.2396	0.2291	0.2588							
EFFP	0.5845	0.8911	0.7820	0.8009	0.7376							
INC1D	-7.95	-8.00	-8.63	-7.33	-5.72							
DEV	9.66	7.66	6.06	8.56	11.76							
DIA	33.564	34.992	36.420	37.848	39.276							

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 70.38
 Corrected Weight Flow = 79.88
 Corrected Rotor Speed = 3932.80
 Pressure Ratio = 1.0515

INLET GUICE VANE 1		STATION C - STATION 1				STATION 1 - STATION 2				SLOTTED ROTOR 1		
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501	
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	26.623	27.398	27.338	27.366	26.886	
BETA 1	26.623	27.398	27.338	27.366	26.886	BETA 2	36.715	36.716	36.095	36.884	38.170	
V 0	339.19	339.19	339.19	339.19	339.19	BETA(PR) 1	46.872	48.398	51.208	52.373	54.195	
V 1	411.37	412.21	412.69	407.31	404.45	BETA(PR) 2	30.886	35.114	38.529	42.434	46.822	
VZ 0	339.19	339.19	339.19	339.19	339.19	V 1	41.137	413.31	402.69	407.31	404.45	
VZ 1	367.76	366.95	357.72	360.74	360.74	V 2	534.92	518.07	508.80	490.05	465.60	
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	367.76	366.95	357.72	361.73	360.74	
V-THETA 1	184.34	190.19	184.93	187.23	182.90	VZ 2	428.61	415.29	411.13	391.97	366.05	
M 0	0.3067	0.3067	0.3067	0.3067	0.3067	V-THETA 1	184.24	190.19	184.92	187.23	182.90	
M 1	0.3736	0.3754	0.3655	0.3698	0.3672	V-THETA 2	319.80	309.72	299.74	294.13	287.74	
TURN	-26.62	-27.40	-27.34	-27.37	-26.89	V(PRI) 1	538.0	552.7	571.0	592.5	616.6	
UUBAR	0.1520	0.1078	0.1520	0.0873	0.0776	V(PRI) 2	499.7	507.7	525.7	531.1	534.9	
DFAC	0.0338	0.062	0.086	0.079	0.064	VTHETA(FR) 1	-392.6	-413.2	-445.0	-469.2	-500.1	
EFFP	0.7802	0.8418	0.7558	0.8604	0.8709	VTHETA(FR) 2	-256.6	-292.0	-327.4	-358.2	-390.1	
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	576.96	603.47	629.96	656.48	682.59	
DEV	6.017	5.352	6.422	8.314	11.224	U 2	576.39	601.75	627.12	652.46	677.64	
						M 1	0.3736	0.3754	0.3655	0.3698	0.3672	
						M 2	0.4823	0.4680	0.4595	0.4419	0.4189	
STATOR	1					M(PRI) 1	0.4886	0.5020	0.5182	0.5379	0.5567	
						M(PRI) 2	0.4515	0.4586	0.4747	0.4789	0.4813	
						TURN(PR)	15.976	13.264	12.678	9.938	7.374	
						UUBAR	0.0253	-0.0021	-0.0005	0.0497	0.1000	
						OFAC	0.1719	0.1734	0.1702	0.1901	0.2188	
						EFFP	0.9068	0.8882	0.9331	0.8052	0.6999	
						EFF	0.9056	0.8869	0.9323	0.8032	0.6862	
						INCID	-4.02	-5.21	-3.77	-3.14	-1.92	
						STATION 2 - STATION 2A						
PCT SPAN	90	70	50	30	10							
BETA 2	36.715	36.716	36.095	36.884	38.170	DEV	8.456	6.214	4.684	4.294	4.832	
BETA 2A	24.903	23.909	22.722	24.5C2	27.364	LOSS PARA	0.00868	-0.00072	-0.00017	0.01654	0.03195	
V 2	534.92	518.07	5C8.80	49C.05	465.60							
V 2A	386.16	375.26	406.95	400.C7	397.79							
V 2	428.81	415.29	411.13	391.97	366.05							
V 2A	350.26	343.06	375.36	364.04	353.28							
V-THETA 2	319.80	309.73	299.74	294.13	287.74							
V-THETA 2A	162.61	152.09	157.19	165.92	182.84							
M 2	0.4623	0.4680	0.4595	0.4419	0.4189							
M 2A	0.3442	0.2360	0.3654	0.3590	0.3565							
TURN	11.812	12.8C7	13.373	12.382	10.806							
UUBAR	0.2456	0.2317	0.1118	0.0823	0.0282							
DFAC	0.2781	0.2757	0.2002	0.1836	0.1456							
EFFP	0.4402	0.6241	0.908C	1.04C6	1.113							
INCID	-10.23	-10.23	-10.85	-10.C07	-10.07							
DEV	7.96	6.97	5.78	7.56	10.42							
DIA	33.564	34.992	36.420	37.848	39.276							

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 90.73
 Corrected Weight Flow = 81.69
 Corrected Rotor Speed = 5069.97

INLET GUIDE VANE 1		STATION 0 - STATION 1				STATION 1 - STATION 2				SLOTTED ROTOR 1		
	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	32.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501	
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	28.770	28.890	28.770	28.773	26.330	
BETA 1	28.770	28.880	28.770	28.773	26.330	BETA 2	53.489	50.768	49.958	52.049	56.622	
V 0	347.68	347.68	347.68	347.68	347.68	BETA(PR) 1	55.794	57.059	58.767	60.434	62.420	
V 1	420.02	424.11	421.45	418.02	407.75	BETA(PR) 2	33.780	36.904	38.572	42.516	47.536	
VZ 0	347.68	347.68	347.68	347.68	347.68	V 1	420.02	424.11	421.49	418.02	407.75	
VZ 1	368.17	371.36	369.46	366.41	365.44	V 2	618.31	620.84	622.27	621.97	607.54	
V-THETA C	-0.00	-C.00	-0.00	-0.00	-0.00	VZ 1	368.17	371.36	369.46	366.41	365.44	
V-THETA 1	262.15	204.83	202.86	201.21	180.85	VZ 2	367.88	392.66	406.77	382.50	334.25	
M C	C.3145	C.3145	C.3145	C.3145	C.3145	V-THETA 1	202.15	2C4.83	202.86	201.21	180.85	
M 1	C.3817	C.3855	C.3831	C.3798	0.3702	V-THETA 2	496.97	480.89	484.05	490.45	507.33	
TURN	-28.77	-28.88	-28.77	-28.77	-26.33	V(PR) 1	654.9	682.9	712.5	741.9	789.3	
UUBAR	0.1315	C.C709	0.0616	0.0472	0.0914	V(PR) 2	442.6	491.0	520.3	518.9	496.0	
DFAC	C.066	C.075	C.080	C.091	0.094	VTHETA PR1	-541.6	-573.1	-609.3	-645.1	-699.6	
EFFP	C.8017	C.8957	C.9071	C.9279	0.8322	VTHETA PR2	-246.1	-294.9	-324.4	-350.7	-365.5	
INCIC	C.0000	C.0000	C.0000	C.0000	0.0000	U 1	743.78	777.96	812.12	846.30	886.47	
DEV	3.870	3.870	4.990	6.907	11.780	U 2	743.05	775.75	808.45	841.14	873.84	
STATOR 1		M 2	0.5454	C.5519	0.5624	M(PR) 1	0.5951	0.6208	0.6476	0.7167	0.7445	
STATION 2 - STATION 2A		M 1	0.5951	0.6208	0.6476	M(PR) 2	0.3904	0.4365	0.4628	0.49368	0.49368	
STATION 2 - STATION 2A		TURN(PR)	22.014	20.195	20.195	TURN(PR)	22.014	20.195	20.195	17.888	14.784	
STATION 2 - STATION 2A		UUBAR	0.0557	C.UC93	0.0141	UUBAR	0.0557	C.UC93	0.0141	0.2123	0.5350	
PCP SPAN		DFAC	0.5040	0.4512	0.4445	DFAC	0.5040	0.4512	0.4445	0.4816	0.5722	
BETA 2		EFFP	0.7233	0.8888	0.9300	EFFP	0.7233	0.8888	0.9300	0.8906	0.7890	
BETA 2A		EFF	C.7144	C.845C	C.9275	EFF	C.7144	C.845C	C.9275	0.8868	C.7814	
V 2		INCIC	4.10	3.45	3.79	INCIC	4.10	3.45	3.79	4.99	6.30	
V 2A		DEV	11.340	8.004	4.732	DEV	11.340	8.004	4.732	4.376	5.546	
VZ 2		LOSS PARA	0.0185	0.0031	0.0048	LOSS PARA	0.0185	0.0031	0.0048	0.0275	0.0668	
VZ 2A		V-THETA 2A	2	179.72	183.93	195.55	203.67	218.78	218.78	218.78	218.78	
M 2		C.5454	C.5519	0.5624	0.5518	M 2A	0.5624	0.5518	0.5350	0.3732	0.3611	
M 2A		C.3180	C.3363	0.3611	0.3732	TURN	0.3611	0.3732	0.3611	0.499	0.702	
TURN		23.989	22.218	21.648	23.499	UUBAR	0.1444	0.1486	0.1497	0.3148	0.3189	
DFAC		0.4097	C.3801	0.3478	0.3478	DFAC	0.4097	C.3801	0.3478	0.2440	0.2440	
EFFP		1.2201	C.8305	0.8729	0.9836	EFFP	1.2201	C.8305	0.8729	0.9836	0.9836	
INCIC		6.54	3.82	3.01	5.10	INCIC	6.54	3.82	5.10	9.67	14.98	
DEV		12.56	11.61	11.37	11.61	DEV	12.56	11.61	11.61	14.98	14.98	
DIA		33.564	34.992	36.420	37.848	DIA	33.564	34.992	36.420	37.848	39.276	

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 91.04
Corrected Weight Flow = 83.68
Corrected Rotor Speed = 5087.47

INLET GUIDE VANE 1		STATION 0 - STATION 1				STATION 1 - STATION 2				SLOTTED ROTOR 1			
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10	
EIA	33.662	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501		
BETA 0	0.000	C.000	0.000	0.000	0.000	BETA 1	26.648	27.209	27.184	27.072	27.246		
BETA 1	26.648	27.209	27.184	27.072	27.246	BETA 2	50.980	49.544	49.122	51.217	54.713		
V 0	357.12	357.12	357.12	357.12	357.12	BETA(PR) 1	54.497	55.894	57.579	59.172	61.118		
V 1	426.67	440.92	438.74	436.14	426.92	BETA(PR) 2	33.533	36.101	38.506	42.275	47.139		
VZ 0	357.12	357.12	357.12	357.12	357.12	V 1	438.67	440.92	438.74	436.14	426.92		
VZ 1	392.08	392.13	388.35	379.55	V 2	624.38	630.78	635.37	625.70	609.45			
V-THETA 0	-0.00	-0.00	-0.00	-0.00	VZ 1	392.08	392.13	390.28	388.35	379.55			
V-THETA 1	196.75	201.61	200.44	198.49	195.45	VZ 2	393.10	409.29	415.82	391.92	352.66		
M 0	0.2222	0.3232	0.3232	0.3232	0.3232	V-THETA 1	196.75	201.61	200.44	198.49	195.45		
M 1	0.2992	0.4013	0.3968	0.3881	0.3881	V-THETA 2	485.10	479.96	480.40	487.74	497.47		
TURN	-26.65	-27.21	-27.18	-27.07	-27.25	V(PR) 1	675.1	699.3	727.9	757.8	785.8		
UUPAR	0.12C9	0.0741	C.0595	0.0468	0.0799	V(PR) 2	471.6	506.6	531.4	529.7	517.6		
CFAC	0.031	0.047	0.053	0.060	0.085	VTHETA PR1	-549.6	-575.6	-614.5	-650.7	-683.1		
EFFP	0.83C1	0.8969	C.9163	C.9341	0.8675	VTHETA PR2	-260.5	-298.5	-330.8	-356.3	-379.4		
INCID	0.0000	0.0000	C.0000	0.0000	0.0000	U 1	746.35	780.65	814.92	849.22	883.51		
CEV	5.992	5.541	6.576	8.608	10.864	U 2	745.62	778.43	811.24	844.05	876.85		
						M 1	0.3992	0.4C13	0.3952	0.3968	0.3981		
						M 2	0.5529	0.5621	0.5668	0.5778			
						M(PR) 1	0.6143	0.6364	0.6624	0.6894	0.7144		
						M(PR) 2	0.4176	0.4514	0.4740	0.4710	0.4567		
						TURN(PR)	20.963	19.193	19.072	16.897	13.979		
						UUBAR	0.0647	0.0397	0.0493	0.1162	0.1784		
						DFAC	0.4721	0.4432	0.4433	0.4784	0.5282		
						EFFP	0.7557	0.9036	0.9540	0.9016	0.7369		
						EFF	0.7481	0.9004	0.9524	0.8933	0.7796		
						INCID	2.81	2.28	2.60	3.06	5.00		
						STATOR 1							
						STATOR 2 - STATION 2A							
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10	
BETA 2	50.980	49.544	49.122	51.217	54.713	DEV	11.093	11.261	4.666	4.135	5.149		
BETA 2A	29.550	28.000	27.700	29.000	32.000	LOSS PARA	0.0216	0.0134	0.0168	0.0388	0.0567		
V 2	624.38	630.78	635.37	625.70	609.45								
V 2A	365.21	394.76	413.75	418.64	411.05								
VZ 2	393.10	4C5.29	415.82	391.92	352.06								
VZ 2A	317.55	348.56	366.37	366.15	348.59								
V-THETA 2	485.10	479.96	480.40	487.74	497.59								
V-THETA 2A	179.89	185.33	192.35	202.96	217.82								
M 2	0.5529	C.5621	C.5668	C.5564	0.5378								
M 2A	0.2184	C.346C	C.3631	C.3669	0.3591								
TURN	21.480	21.544	21.422	22.217	22.713								
UUPAR	0.1519	C.13E1	0.1386	0.1280	0.1462								
CFAC	C.414S	C.3742	C.3487	C.3309	0.3225								
EFFP	0.9736	C.9075	0.858C	C.9114	1.1392								
INCID	4.03	2.59	2.17	4.21	7.76								
CEV	12.56	11.06	1C.76	12.06	15.06								
DIA	33.564	34.992	36.420	37.848	39.276								

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 91.54
Corrected Weight Flow = 88.81
Corrected Rotor Speed = 5115.30

INLET GLIDE VANE 1

STATION 0 - STATION 1						STATION 1 - STATION 2						SLOTTED ROTOR 1					
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	32.622	35.167	36.711	38.256	39.801	DIA	33.589	35.667	36.545	38.023	39.501	V 0	27.593	27.274	27.601	27.218	27.051
BETA C	0.000	0.000	C.000	0.000	0.000	BETA 1	26.593	27.051	45.610	45.208	46.974	BETA 1A	27.274	27.051	45.610	45.208	46.974
BETA 1	26.593	27.274	27.6C1	27.218	27.051	BETA 2	46.026	51.996	53.491	55.309	56.990	V 1	381.92	381.92	381.92	36.160	38.454
V 0	381.92	381.52	381.92	381.92	381.92	BETA(PR) 1	51.996	36.160	36.160	36.160	36.160	BETA(PR) 2	33.4C3	36.160	36.160	36.160	36.160
V 1	471.37	472.12	469.95	467.55	457.11	BETA(PR) 2	33.4C3	36.160	36.160	36.160	36.160	VZ 0	381.92	381.92	381.92	381.92	381.92
VZ 0	381.92	381.52	381.92	381.92	381.92	V 1	471.37	473.12	469.95	467.55	457.11	VZ 1	415.78	407.10	421.50	421.50	421.50
VZ 1	421.50	42C.52	416.47	415.78	407.10	V 2	636.66	638.49	642.69	642.69	642.69	V-THETA C	-C.00	-0.00	-0.00	-0.00	-0.00
V-THETA C	-0.00	-C.C0	-C.00	-0.00	-0.00	VZ 1	421.50	42C.52	416.47	415.78	407.10	V-THETA 1	216.81	207.88	213.85	213.85	207.88
V-THETA 1	211.01	216.81	217.73	213.85	207.88	VZ 2	442.06	446.65	452.80	421.74	395.93	M 0	C.3462	0.3462	V-THETA 1	211.01	216.81
M 0	C.3462	C.3462	C.3462	C.3462	C.3462	V-THETA 1	211.01	216.81	217.73	213.85	207.88	M 1	C.4300	C.4316	C.4286	456.26	456.26
M 1	C.4300	C.4316	C.4286	0.4165	0.4165	V-THETA 2	458.18	456.26	456.26	456.26	456.26	TURN	-27.27	-27.05	684.6	706.8	731.7
TURN	-26.59	-27.27	-27.60	-27.22	-27.05	V(PR) 1	706.8	706.8	706.8	706.8	706.8	UUBAR	0.0402	0.0796	V(PR) 2	529.5	553.2
UUBAR	0.1C44	C.C642	C.0539	0.0402	0.0796	V(PR) 2	529.5	553.2	578.2	578.2	579.1	CFAC	0.C26	0.C55	VTHETA PR1	-539.4	-568.1
CFAC	0.C26	0.C045	C.C55	0.059	0.082	VTHETA PR1	-539.4	-568.1	-601.6	-601.6	-601.6	EFFP	0.0541	0.9241	0.8675	-326.4	-359.6
EFFP	0.0541	0.9116	0.9241	0.9442	0.8675	VTHETA PR2	-291.5	-291.5	-291.5	-291.5	-291.5	INCIC	0.C000	0.C000	U 1	750.43	784.92
INCIC	0.C000	C.C000	C.C000	0.0000	0.0000	U 1	750.43	784.92	819.92	819.92	819.92	CEV	6.047	5.476	6.159	8.462	11.059
CEV	6.047	5.476	6.159	8.462	11.059	M 1	0.4300	0.4316	0.4316	0.4316	0.4316	STATOR 1	0.5699	0.5733	M 2	0.5778	0.5544
STATOR 1	0.5699	0.5733	0.5733	0.5733	0.5733	M(PR) 1	0.6245	0.6448	0.6674	0.6674	0.6674	STATION 2 - STATION 2A	0.6245	0.6448	0.6674	0.6674	0.6674
STATION 2 - STATION 2A	0.6245	0.6448	0.6674	0.6674	0.6674	M(PR) 2	0.4740	0.4740	0.4967	0.4967	0.4967	TURN(PR)	18.593	17.330	16.854	16.854	16.854
TURN(PR)	18.593	17.330	16.854	16.854	16.854	UUBAR	0.0306	C.0263	0.0265	0.0265	0.0265	DFAC	0.3708	0.3603	0.3546	0.3546	0.3546
DFAC	0.3708	0.3603	0.3603	0.3603	0.3603	EFFP	0.8641	0.9652	1.0317	1.0317	1.0317	EFF	0.8603	0.9642	1.0327	1.0327	1.0327
EFF	0.8603	0.9642	1.0327	1.0327	1.0327	INCID	C.31	-C.12	0.33	0.33	0.33	INCID	C.31	-C.12	0.33	1.48	2.99
PCT SPAN	90	70	50	30	10	DEV	10.963	7.260	4.614	5.116	4.698	V 2A	381.64	418.10	420.74	411.18	410.963
BETA 2	46.C26	45.610	45.208	46.974	49.384	LOSS PARA	0.0102	0.0089	0.0089	0.0089	0.0089	VZ 2A	442.C6	446.65	452.80	421.74	421.74
BETA 2A	28.200	27.500	26.5C0	27.000	32.000	VZ 2A	32.34	37C.86	382.14	374.88	348.70	V-THETA 2A	456.1E	456.26	456.09	451.84	451.84
V 2	636.66	638.49	642.69	618.08	608.20	V-THETA 2A	180.34	193.C6	190.53	191.01	217.89	M 2	C.5699	C.5733	C.5778	0.5544	0.5544
V 2	381.64	418.10	427.00	420.74	411.18	M 2A	0.334C	C.3689	C.3768	C.3707	C.3707	TURN	17.826	18.11C	18.708	19.974	17.384
TURN	17.826	18.11C	18.708	19.974	19.974	UUBAR	0.1657	C.1122	C.1281	C.0996	C.0996	DFAC	0.4CC6	0.3452	C.3356	0.3193	0.3239
DFAC	0.4CC6	0.3452	C.3356	0.3193	0.3239	EFFP	C.6543	C.87C9	C.7807	0.7601	0.8994	EFFP	C.6543	C.87C9	C.7807	0.7601	0.8994
EFFP	C.6543	C.87C9	-C.92	-1.34	-1.74	INCID	-C.92	-1.34	-1.74	0.02	2.43	INCID	-C.92	-1.34	-1.74	0.02	2.43
CEV	11.26	10.56	9.56	10.06	15.06	DIA	33.564	34.992	36.420	37.848	39.276	DIA	33.564	34.992	36.420	37.848	39.276

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Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 91.61
 Corrected Weight Flow = 92.37
 Corrected Rotor Speed = 5119.28

INLET GUIDE VANE 1										STATION 0 - STATION 1										STATION 1 - STATION 2										
SLOTTED					ROTOR					SLOTTED					ROTOR					SLOTTED					ROTOR					
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10							
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501	BETA 0	0.000	0.000	BETA 1	28.900	29.000	BETA 2	28.900	29.000	BETA 3	29.200	29.200							
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	29.000	29.200	BETA 2	29.000	29.200	BETA 2A	0.000	0.000	BETA 3A	43.459	42.716	BETA 4	42.408	43.256	BETA 5	45.521	45.521							
BETA 1	28.900	29.000	29.000	29.000	29.000	BETA 2	29.000	29.200	BETA 3	29.000	29.200	BETA 3A	43.459	42.716	BETA 4A	42.716	43.024	BETA 5A	43.256	43.256	BETA 6	54.787	57.008							
V 0	399.56	399.56	399.56	399.56	399.56	V 1	495.47	485.16	V 2	495.47	485.16	V 3	495.47	485.16	V 4	495.47	485.16	V 5	495.47	485.16	V 6	495.47	485.16							
V 1	494.61	500.67	498.04	495.47	495.47	V 2	399.56	399.56	V 3	399.56	399.56	V 4	399.56	399.56	V 5	399.56	399.56	V 6	399.56	399.56	V 7	399.56	399.56							
V 2	0	399.56	399.56	399.56	399.56	V 3	435.55	432.50	V 4	435.55	432.50	V 5	435.55	432.50	V 6	435.55	432.50	V 7	435.55	432.50	V 8	435.55	432.50							
V 4	-0.00	-0.00	-0.00	-0.00	-0.00	V 5	241.72	236.69	V 6	241.72	236.69	V 7	241.72	236.69	V 8	241.72	236.69	V 9	241.72	236.69	V 10	241.72	236.69							
V -THETA 0	239.04	242.73	244.45	241.72	236.69	V -THETA 1	0.3626	0.3626	V -THETA 2	0.3626	0.3626	V -THETA 3	0.3626	0.3626	V -THETA 4	0.3626	0.3626	V -THETA 5	0.3626	0.3626	V -THETA 6	0.3626	0.3626							
V -THETA 1	0	0.3626	0.3626	0.3626	0.3626	V -THETA 2	0.4520	0.4528	V -THETA 3	0.4520	0.4528	V -THETA 4	0.4520	0.4528	V -THETA 5	0.4520	0.4528	V -THETA 6	0.4520	0.4528	V -THETA 7	0.4520	0.4528							
M 0	0.4520	0.4528	0.4528	0.4528	0.4528	M 1	-28.90	-29.00	M 2	-29.00	-29.00	M 3	-29.00	-29.00	M 4	-29.00	-29.00	M 5	-29.00	-29.00	M 6	-29.00	-29.00							
M 1	0.1317	0.0643	0.0494	0.0376	0.0376	M 2	0.1317	0.0643	M 3	0.1317	0.0643	M 4	0.1317	0.0643	M 5	0.1317	0.0643	M 6	0.1317	0.0643	M 7	0.1317	0.0643							
TURN	0.044	0.051	0.056	0.066	0.066	TURN	0.9158	0.9349	TURN	0.9158	0.9349	TURN	0.9158	0.9349	TURN	0.9158	0.9349	TURN	0.9158	0.9349	TURN	0.9158	0.9349							
UUBAR	0.8221	0.9158	0.9511	0.9872	0.9872	UFFP	0.0000	0.0000	UFFP	0.0000	0.0000	UFFP	0.0000	0.0000	UFFP	0.0000	0.0000	UFFP	0.0000	0.0000	UFFP	0.0000	0.0000							
DFAC	INCID	INCID	INCID	INCID	INCID	DEV	3.740	3.750	4.760	6.480	8.910	DEV	3.740	3.750	4.760	6.480	8.910	DEV	3.740	3.750	4.760	6.480	8.910	DEV	3.740	3.750	4.760	6.480	8.910	
STATOR 1										STATOR 2 - STATION 2A										STATION 2 - STATION 2A										
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10							
BETA 2	43.459	42.716	42.408	43.256	45.521	EFF	0.3662	0.3883	EFF	0.3662	0.3883	EFF	0.3662	0.3883	EFF	0.3662	0.3883	EFF	0.3662	0.3883	EFF	0.3662	0.3883	EFF	0.3662	0.3883	EFF	0.3662	0.3883	
BETA 2A	28.000	26.000	24.000	26.000	31.000	INCID	658.97	651.98	INCID	645.03	624.10	INCID	594.85	594.85	INCID	594.85	594.85	INCID	594.85	594.85	INCID	594.85	594.85	INCID	594.85	594.85	INCID	594.85	594.85	
V 2	416.09	437.97	446.04	434.80	421.78	DEV	195.34	191.99	DEV	181.42	190.60	DEV	217.23	217.23	DEV	217.23	217.23	DEV	217.23	217.23	DEV	217.23	217.23	DEV	217.23	217.23	DEV	217.23	217.23	
V 2A	0.5943	0.5887	0.5887	0.5887	0.5887	LOSS PARA	478.32	479.03	LOSS PARA	476.26	454.53	LOSS PARA	416.78	416.78	LOSS PARA	416.78	416.78	LOSS PARA	416.78	416.78	LOSS PARA	416.78	416.78	LOSS PARA	416.78	416.78	LOSS PARA	416.78	416.78	
V 2Z	2	367.39	393.64	407.48	390.80	361.54	TURN	15.459	16.716	TURN	18.408	17.256	TURN	14.521	14.521	TURN	14.521	14.521	TURN	14.521	14.521	TURN	14.521	14.521	TURN	14.521	14.521	TURN	14.521	14.521
V 2ZA	2	453.26	442.28	435.01	427.67	424.43	V -THETA 2	19.534	191.99	V -THETA 3	181.42	190.60	V -THETA 4	190.60	190.60	V -THETA 5	190.60	190.60	V -THETA 6	190.60	190.60	V -THETA 7	190.60	190.60	V -THETA 8	190.60	190.60	V -THETA 9	190.60	190.60
V -THETA 2A	2	0.3666	0.3883	0.3958	0.3852	0.3727	V -THETA 2A	0.3666	0.3883	V -THETA 3A	0.3883	0.3883	V -THETA 4A	0.3883	0.3883	V -THETA 5A	0.3883	0.3883	V -THETA 6A	0.3883	0.3883	V -THETA 7A	0.3883	0.3883	V -THETA 8A	0.3883	0.3883	V -THETA 9A	0.3883	0.3883
V -THETA 2AA	2	0.1871	0.1375	0.1250	0.1184	0.1093	V -THETA 2AA	0.3666	0.3283	V -THETA 3AA	0.3085	0.3033	V -THETA 4AA	0.2909	0.2909	V -THETA 5AA	0.2909	0.2909	V -THETA 6AA	0.2909	0.2909	V -THETA 7AA	0.2909	0.2909	V -THETA 8AA	0.2909	0.2909	V -THETA 9AA	0.2909	0.2909
V -THETA 2AAA	2	0.6158	0.7908	0.7720	0.7514	0.8451	V -THETA 2AAA	-3.49	-4.23	V -THETA 3AAA	-4.54	-3.69	V -THETA 4AAA	-1.43	-1.43	V -THETA 5AAA	-1.43	-1.43	V -THETA 6AAA	-1.43	-1.43	V -THETA 7AAA	-1.43	-1.43	V -THETA 8AAA	-1.43	-1.43	V -THETA 9AAA	-1.43	-1.43
DEV	11.06	9.06	7.06	7.06	9.06	14.06	DIA 2A	33.564	34.99	DIA 2A	36.420	37.848	DIA 2A	39.276	39.276	DIA 2A	39.276	39.276	DIA 2A	39.276	39.276	DIA 2A	39.276	39.276	DIA 2A	39.276	39.276			

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 90.60
Corrected Weight Flow = 95.47
Corrected Rotor Speed = 5062.62

INLET GUIDE VANE 1		STATION 0 - STATION 1										STATION 1 - STATION 2										SLOTTED ROTOR 1	
PCT SPAN		90	70	50	30	10	PCT SPAN		90	70	50	30	10	PCT SPAN		90	70	50	30	10	PCT SPAN		
DIA	32.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501			BETA 1	27.000	27.500	27.500	27.000	25.000		BETA 1	27.500	27.000
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 2	40.000	40.000	39.000	40.000	42.000			BETA 2	40.000	40.000	39.000	40.000	42.000		BETA 2	40.000	42.000
BETA 1	27.000	27.500	27.000	25.000	25.000	BETA(PR) 1	47.696	49.068	51.225	51.225	53.216			BETA(PR) 1	47.696	49.068	51.225	53.216	55.645		BETA(PR) 1	47.696	55.645
V 0	415.22	415.22	415.22	415.22	415.22	BETA(PR) 2	31.607	34.883	37.750	41.673	45.394			BETA(PR) 2	31.607	34.883	37.750	41.673	45.394		BETA(PR) 2	31.607	45.394
V 1	518.27	523.27	517.85	513.49	502.83	V 1	518.27	523.27	517.85	513.49	502.83			V 1	518.27	523.27	517.85	513.49	502.83		V 1	518.27	502.83
VZ 0	415.22	415.22	415.22	415.22	415.22	V 2	665.94	658.22	655.76	634.07	607.71			V 2	665.94	658.22	655.76	634.07	607.71		V 2	665.94	607.71
VZ 1	461.78	464.14	459.34	457.53	455.72	VZ 1	461.78	464.14	459.34	457.53	455.72			VZ 1	461.78	464.14	459.34	457.53	455.72		VZ 1	461.78	455.72
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	V-THETA 1	235.29	241.62	239.12	233.12	212.51			V-THETA 1	235.29	241.62	239.12	233.12	212.51		V-THETA 1	235.29	212.51
V-THETA 1	235.29	241.62	239.12	233.12	212.51	V-THETA 2	0.3772	0.3772	0.3772	0.3772	0.3772			V-THETA 2	0.4599	0.4599	0.4599	0.4599	0.4599		V-THETA 2	0.4599	0.4599
M 0	0.3772	0.3772	0.3772	0.3772	0.3772	M 1	0.4746	0.4794	0.4742	0.4700	0.4700			M 1	0.4746	0.4794	0.4742	0.4700	0.4700		M 1	0.4746	0.4700
M 1	0.4746	0.4794	0.4742	0.4700	0.4700	M 2	-27.50	-27.00	-27.00	-25.00	-25.00			M 2	-27.50	-27.00	-27.00	-25.00	-25.00		M 2	-27.50	-25.00
TURN	-27.00	-27.00	-27.00	-27.00	-27.00	TURN	0.0502	0.0444	0.0444	0.0415	0.0415			TURN	0.0502	0.0444	0.0444	0.0415	0.0415		TURN	0.0502	0.0444
UUBAR	0.1121	0.1121	0.1121	0.1121	0.1121	UUBAR	0.019	0.019	0.019	0.019	0.019			UUBAR	0.019	0.019	0.019	0.019	0.019		UUBAR	0.019	0.019
CFAC	0.9448	0.9448	0.9448	0.9448	0.9448	CFAC	0.9333	0.9333	0.9333	0.9333	0.9333			CFAC	0.9333	0.9333	0.9333	0.9333	0.9333		CFAC	0.9333	0.9333
EFFFP	0.8519	0.8519	0.8519	0.8519	0.8519	EFFFP	0.0000	0.0000	0.0000	0.0000	0.0000			EFFFP	0.0000	0.0000	0.0000	0.0000	0.0000		EFFFP	0.0000	0.0000
INCID	C.0000	C.0000	C.0000	C.0000	C.0000	INCID	5.640	5.25C	6.26C	8.680	13.110			INCID	5.640	5.25C	6.26C	8.680	13.110		INCID	5.640	13.110
DEV						STATOR 1								STATOR 1							STATOR 1		
						STATION 2 - STATION 2A								STATION 2 - STATION 2A							STATION 2 - STATION 2A		
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10			PCT SPAN	90	70	50	30	10		PCT SPAN	90	70
BETA 2	4C.CCC	4C.CCC	4C.CCC	40.000	42.000	DEV	9.167	5.983	3.910	3.533	3.304			BETA 2	40.000	42.000	44.000	46.000	48.000		BETA 2	40.000	48.000
BETA 2A	27.000	25.500	23.000	24.500	28.000	EFF	0.9396	0.9005	0.9301	0.8863	0.8863			EFF	0.9396	0.9005	0.9301	0.8863	0.8863		EFF	0.9396	0.8863
V 2	665.94	658.22	655.76	634.07	607.71	INCID	-3.99	-4.54	-3.75	-2.29	-0.47			INCID	-3.99	-4.54	-3.75	-2.29	-0.47		INCID	-3.99	-0.47
V 2A	470.66	474.76	476.85	461.35	434.59	LOSS PARA	0.0017	0.0072	0.0031	0.0228	0.0228			LOSS PARA	0.0017	0.0072	0.0031	0.0228	0.0228		LOSS PARA	0.0017	0.0228
VZ 2	510.14	504.23	509.62	485.72	451.62	TURN(PR)	16.089	14.185	13.475	11.543	9.752			TURN(PR)	16.089	14.185	13.475	11.543	9.752		TURN(PR)	16.089	9.752
VZ 2A	419.54	428.51	428.94	419.81	383.72	UUBAR	0.0051	0.0210	0.0090	0.0677	0.1482			UUBAR	0.0051	0.0210	0.0090	0.0677	0.1482		UUBAR	0.0051	0.1482
V-THETA 2	428.06	423.1C	412.68	407.57	406.64	DFAC	0.2394	0.2409	0.2274	0.2570	0.3157			DFAC	0.2394	0.2409	0.2274	0.2570	0.3157		DFAC	0.2394	0.3157
V-THETA 2A	213.77	204.29	186.32	191.32	204.03	EFFFP	0.922C	0.8866	0.8863	0.8863	0.8863			EFFFP	0.922C	0.8866	0.8863	0.8863	0.8863		EFFFP	0.922C	0.8863
M 2	0.6021	C.5958	0.5958	0.5728	0.5476	UBAR	0.0054	0.0214	0.0092	0.0677	0.1482			UBAR	0.0054	0.0214	0.0092	0.0677	0.1482		UBAR	0.0054	0.1482
M 2A	0.4165	0.4237	0.4237	0.4112	0.3859	UBAR	0.0055	0.0215	0.0093	0.0678	0.1483			UBAR	0.0055	0.0215	0.0093	0.0678	0.1483		UBAR	0.0055	0.1483
TURN	12.000	14.500	16.000	15.500	14.000	UBAR	0.1174	0.1174	0.1174	0.1174	0.1174			UBAR	0.1174	0.1174	0.1174	0.1174	0.1174		UBAR	0.1174	0.1174
UUBAR	C.1465	C.1155	C.1155	C.1175	C.1175	UBAR	0.2787	0.2728	0.2728	0.2728	0.2728			UBAR	0.2787	0.2728	0.2728	0.2728	0.2728		UBAR	0.2787	0.2728
DFAC	0.2929	0.2787	0.2787	0.2724	0.2849	UBAR	0.922C	0.922C	0.922C	0.922C	0.922C			UBAR	0.922C	0.922C	0.922C	0.922C	0.922C		UBAR	0.922C	0.922C
EFFFP	0.5893	C.92C4	C.92C4	0.8866	0.6879	UBAR	0.4237	0.4237	0.4237	0.4237	0.4237			UBAR	0.4237	0.4237	0.4237	0.4237	0.4237		UBAR	0.4237	0.4237
INCID	-6.95	-6.55	-7.95	-6.95	-4.95	UBAR	0.4000	39.00	40.00	42.00	42.00			UBAR	0.4000	39.00	40.00	42.00	42.00		UBAR	0.4000	42.00
INCIDS	4C.CC	40.00	39.00	39.00	39.00	UBAR	8.56	6.06	7.56	11.06	11.06			UBAR	8.56	6.06	7.56	11.06	11.06		UBAR	8.56	11.06
DEV	1C.C6	34.992	36.420	37.848	39.276	UBAR	33.564							DEV	33.564	36.420	37.848	39.276	UBAR		DEV	33.564	UBAR

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 91.06
Corrected Weight Flow = 98.10
Corrected Rotor Speed = 5088.29

INLET GUIDE VANE 1										SLOTTED ROTOR 1									
STATION 0 - STATION 1					STATION 1 - STATION 2					STATION 1 - STATION 1					STATION 1 - STATION 2				
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	PCT SPAN	90	70	50	30	10			
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	DIA	33.589	35.067	36.545	38.023	39.501			
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	29.002	29.117	29.207	29.627	BETA 2	26.942	27.120	27.336	27.704	26.114			
BETA 1	29.002	29.117	29.207	29.627	26.114	BETA 2	26.942	27.120	27.336	27.704	BETA (PR) 1	45.527	47.097	49.274	51.269	37.756			
V 0	428.72	428.72	428.72	428.72	428.72	BETA (PR) 2	31.659	36.461	38.958	42.271	BETA (PR) 3	31.659	36.461	38.958	42.271	54.042			
V 1	542.61	547.28	542.71	538.19	526.63	BETA (PR) 4	31.659	36.461	38.958	42.271	BETA (PR) 5	31.659	36.461	38.958	42.271	47.078			
VZ 0	428.72	428.72	428.72	428.72	428.72	V 1	542.61	547.28	542.71	538.19	V 2	681.77	652.71	651.81	635.36	526.63			
VZ 1	474.57	478.12	473.71	467.83	472.87	V 2	681.77	652.71	651.81	635.36	VZ 1	474.57	478.12	473.71	467.83	599.68			
V-THETA C	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 2	544.90	520.45	520.45	520.45	V-THETA PR1	-483.4	-514.5	-514.5	-514.5	472.87			
V-THETA 1	263.08	266.30	264.82	266.05	231.80	V-THETA PR2	-336.0	-384.7	-425.2	-460.0	V-THETA 1	263.08	266.30	266.30	266.30	474.57			
M 0	0.3898	0.3898	0.3898	0.3898	0.3898	V-THETA 2	409.75	393.90	386.21	384.17	M 1	0.4981	0.4937	0.4826	0.4826	0.4981			
M 1	0.4980	0.5025	0.4981	0.4981	0.4981	V(PR) 1	677.4	702.3	726.1	747.7	M 2	0.5025	0.4937	0.4826	0.4826	0.5025			
TURN	-29.00	-29.12	-29.21	-29.63	-26.11	V(PR) 2	640.2	647.2	675.6	683.9	UUBAR	0.0609	0.0718	0.0718	0.0718	0.0609			
UUBAR	0.1314	0.0609	0.0513	0.0397	0.0397	VTHETA PR1	-483.4	-514.5	-550.2	-583.3	DFAC	0.017	0.034	0.044	0.049	0.017			
DFAC	0.8396	0.9267	0.9364	0.9501	0.8948	VTHETA PR2	-336.0	-384.7	-425.2	-460.0	EFFP	0.0000	0.0000	0.0000	0.0000	0.0000			
EFFP	0.8396	0.9267	0.9364	0.9501	0.8948	U 1	746.47	780.77	815.05	849.35	INCID	0.0000	0.0000	0.0000	0.0000	0.0000			
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 2	745.74	778.55	811.37	844.18	DEV	3.638	3.633	4.553	6.053	3.638			
DEV	3.638	3.633	4.553	6.053	11.996	M 1	0.4980	0.5025	0.5025	0.4937	M 2	0.4980	0.5025	0.5025	0.4937	0.4980			
STATOR 1					STATOR 2 - STATION 3					STATION 2 - STATION 3					STATION 2 - STATION 3				
PCT SPAN	90	70	50	30	10	M 1	0.5939	0.5939	0.5939	0.5939	M 2	0.6216	0.6216	0.6216	0.6216	0.5939			
BETA 2	36.942	37.120	36.336	37.204	37.756	M 1	0.6217	0.6448	0.6663	0.6659	BETA 2A	25.000	23.000	24.000	27.000	0.6217			
BETA 2A	26.000	25.000	25.000	25.000	25.000	M 1	0.6217	0.6448	0.6663	0.6659	M 2	0.5939	0.5939	0.5939	0.5939	0.6217			
V 2	681.77	652.71	651.81	635.36	599.68	M 1	0.5837	0.5889	0.6156	0.6219	V 2A	520.11	498.02	497.90	492.56	0.5837			
V 2A	520.11	498.02	497.90	497.90	497.90	M 2	0.5837	0.5889	0.6156	0.6219	VZ 2	544.90	520.45	525.07	506.05	0.5837			
VZ 2	544.90	520.45	525.07	525.07	525.07	TURN (PR)	1.3	1.3	1.3	1.3	VZ 2A	467.47	451.36	458.32	449.97	467.47			
VZ 2A	467.47	451.36	458.32	449.97	449.97	UUBAR	0.0835	-0.0186	-0.0186	-0.0186	V-THETA 2	409.75	393.90	386.21	384.17	409.75			
V-THETA 2	409.75	393.90	386.21	384.17	367.18	DFAC	0.1418	0.1562	0.1562	0.1562	DFAC	210.47	194.54	200.34	211.24	210.47			
DFAC	228.00	210.47	194.54	200.34	211.24	EFFP	1.0240	0.8960	1.0064	1.0064	EFF	520.45	492.56	465.29	465.29	520.45			
EFFP	520.45	492.56	465.29	465.29	465.29	INCID	-6.16	-6.16	-6.16	-6.16	INCID	10.942	12.120	13.336	13.204	10.942			
INCID	10.942	12.120	13.336	13.204	13.204	TURN	0.0284	0.0284	0.0284	0.0284	TURN	0.0284	0.0284	0.0284	0.0284	0.0284			
TURN	0.0284	0.0284	0.0284	0.0284	0.0284	U 1	0.1466	0.1618	0.1466	0.1466	U 2	0.1738	0.1738	0.1738	0.1738	0.1738			
U 1	0.1738	0.1738	0.1738	0.1738	0.1738	U 2	0.2371	0.2371	0.2371	0.2371	U 2A	0.5056	0.8263	0.6368	0.6368	0.5056			
U 2A	0.2371	0.2371	0.2371	0.2371	0.2371	U 2B	-10.01	-9.83	-10.61	-9.75	U 2B	-10.01	-9.83	-10.61	-9.75	-10.01			
U 2B	-10.01	-9.83	-10.61	-9.75	-9.19	DEV	9.06	8.06	6.06	7.06	DEV	33.564	34.992	36.420	37.848	39.276			
DEV	9.06	8.06	6.06	7.06	10.06	DIA	33.564	34.992	36.420	37.848	DIA								

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 99.75
Corrected Weight Flow = 85.19
Corrected Rotor Speed = 5574.20

INLET GUIDE VANE 1										SLOTTED ROTOR 1										
STATION 0 - STATION 1					STATION 1 - STATION 2					STATION 1 - STATION 2					STATION 1 - STATION 2					
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	PCT SPAN	90	70	50	30	10				
CIA	23.622	35.167	36.711	38.256	39.801	CIA	33.589	35.067	36.545	38.023	CIA	26.723	27.238	27.427	26.858	27.119				
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	27.119	BETA 2	58.207	53.261	BETA 1	58.207	53.261	52.327	53.867	59.848				
BETA 1	26.720	27.238	27.427	26.858	27.119	BETA 2	58.207	BETA 1	57.093	58.458	BETA 2	57.093	58.458	60.012	61.547	63.346				
V C	364.37	364.37	364.37	364.37	364.37	BETA(PR) 1	364.37	BETA(PR) 2	35.274	37.867	BETA(PR) 1	35.274	37.867	38.519	42.417	48.917				
V 1	446.87	448.71	446.73	443.48	434.29	BETA(PR) 2	443.48	V 1	446.87	446.73	BETA(PR) 2	446.87	446.73	443.48	443.48	434.28				
VZ 0	364.37	364.37	364.37	364.37	364.37	V 1	446.87	V 2	66.8.20	67.3.44	V 1	446.87	446.73	443.48	443.48	434.28				
VZ 1	399.15	398.95	396.52	395.64	386.53	V 2	66.8.20	V 1	39.9.15	398.95	V 2	66.8.20	67.3.44	695.51	686.86	666.79				
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	V(PR) 1	734.7	V(PR) 2	431.2	510.3	V(PR) 1	734.7	762.6	793.3	830.4	861.6				
V-THETA 1	200.93	205.37	205.77	200.35	197.96	V(PR) 2	431.2	V(PR) 1	616.8	-650.0	V(PR) 2	431.2	510.3	543.3	395.52	386.53				
W C	0.3299	0.3299	0.3299	0.3299	0.3299	V-THETA 1	200.93	V-THETA 2	567.94	539.67	V-THETA 1	200.93	205.37	205.77	205.77	200.35	197.96			
W 1	0.4069	0.4086	0.4067	0.4037	0.3950	V-THETA 2	567.94	V-THETA 1	734.7	762.6	V-THETA 2	567.94	539.67	550.51	554.74	576.57				
TURN	-26.72	-27.24	-27.43	-26.86	-27.12	V(PR) 1	734.7	V(PR) 2	431.2	510.3	V(PR) 1	734.7	762.6	793.3	830.4	861.6				
UUBAR	0.1059	0.0666	0.0544	0.0459	0.0377	V(PR) 2	431.2	V(PR) 1	616.8	-650.0	V(PR) 2	431.2	510.3	543.3	548.6	509.7				
DFAC	0.033	0.050	0.057	0.061	0.087	VTHETA PR1	-616.8	VTHETA PR2	-249.0	-313.2	VTHETA PR1	-616.8	-650.0	-687.1	-730.1	-770.1				
EFFP	0.8480	0.9062	0.9229	0.9337	0.8667	VTHETA PR2	-249.0	VTHETA PR1	817.76	855.33	VTHETA PR2	-249.0	-313.2	-338.3	-370.1	-384.2				
INCID	0.00000	0.00000	0.00000	0.00000	0.00000	U 1	817.76	U 2	816.95	852.90	U 1	817.76	855.33	892.89	930.46	968.04				
DEV	5.920	5.512	6.333	8.822	10.991	M 1	0.4069	M 2	0.4086	0.4067	M 1	0.4069	0.4086	0.4086	0.4037	0.3950				
						STATOR 1					STATOR 1									
						STATION 2 - STATION 2A					STATION 2 - STATION 2A					STATION 2 - STATION 2A				
						PCT SPAN	90	70	50	30	PCT SPAN	90	70	50	30	PCT SPAN	90	70	50	
BETA 2	58.207	53.261	52.327	53.867	59.848	DEV	12.834	8.967	4.679	4.679	DEV	12.834	8.967	4.679	4.679	4.679	6.927			
BETA 2A	33.242	29.350	404.95	445.67	480.37	EFFP	0.04455	0.01597	0.01597	0.01597	EFFP	0.04455	0.01597	0.01597	0.01597	0.01597	0.03785	0.06651		
V 2	668.20	673.44	695.51	686.86	666.79	EFF	0.7054	0.8333	0.9223	0.8632	EFF	0.7054	0.8333	0.9223	0.8632	0.8632	0.7453			
V 2A	370.50	28.274	29.435	32.052	32.052	INCID	5.40	4.85	5.03	5.03	INCID	5.40	4.85	5.03	5.03	5.03	7.23			
VZ 2	352.04	402.83	425.07	405.02	334.93	UUBAR	0.1364	0.0484	0.0484	0.0476	UUBAR	0.1364	0.0484	0.0484	0.0476	0.0476	0.2168			
VZ 2A	309.87	352.97	392.50	426.69	407.15	DFAC	0.6125	0.5153	0.5153	0.5071	DFAC	0.6125	0.5153	0.5153	0.5071	0.5071	0.6212			
V-THETA 2	567.94	539.67	550.51	554.74	576.57	M(PR) 1	0.6689	0.6945	0.6945	0.7223	M(PR) 1	0.6689	0.6945	0.6945	0.7223	0.7223	0.7838			
V-THETA 2A	203.10	198.48	211.11	240.77	254.93	M(PR) 2	0.3773	0.4499	0.4499	0.4807	M(PR) 2	0.3773	0.4499	0.4499	0.4807	0.4807	0.4444			
M 2	0.5847	0.5938	0.6154	0.6050	0.5814	TURN(PR)	21.820	20.591	20.591	21.493	TURN(PR)	21.820	20.591	20.591	21.493	21.493	14.429			
M 2A	0.3195	0.3506	0.3867	0.4257	0.4154	U 1	19.130	19.130	19.130	19.130	U 1	19.130	19.130	19.130	19.130	19.130	14.429			
TURN	24.965	23.911	24.053	24.432	27.796	U 2	14.290	14.290	14.290	14.290	U 2	14.290	14.290	14.290	14.290	14.290	14.290			
UUBAR	0.2290	0.2060	0.2086	0.1139	0.1229	U 3	14.290	14.290	14.290	14.290	U 3	14.290	14.290	14.290	14.290	14.290	14.290			
DFAC	0.4455	0.3987	0.3592	0.2867	0.2795	U 4	14.290	14.290	14.290	14.290	U 4	14.290	14.290	14.290	14.290	14.290	14.290			
EFFP	1.0867	0.8489	0.76C9	1.0199	1.4733	U 5	14.290	14.290	14.290	14.290	U 5	14.290	14.290	14.290	14.290	14.290	14.290			
INCID	11.26	6.31	5.38	6.92	12.93	U 6	14.290	14.290	14.290	14.290	U 6	14.290	14.290	14.290	14.290	14.290	14.290			
DEV	16.30	12.41	11.33	12.50	15.11	DIA	33.564	34.992	36.420	37.848	DIA	33.564	34.992	36.420	37.848	39.276				

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 99.79
Corrected Weight Flow = 90.88
Corrected Rotor Speed = 5576.10

INLET GUIDE VANE		STATION 0 - STATION 1					STATION 1 - STATION 2					SLOTTED ROTOR 1	
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10	
DIA	33.622	35.167	36.712	38.256	39.801	DIA	33.590	35.070	36.550	38.020	39.500		
BETA J	0.000	0.000	0.000	0.000	0.000	BETA 1	26.609	27.239	27.311	27.016	27.234		
BETA 1	26.609	27.239	27.311	27.016	27.234	BETA 2	54.141	50.993	50.457	52.325	55.952		
V 0	392.12	392.12	392.12	392.12	392.12	BETA(PR) 1	54.082	55.353	57.155	58.291	60.566		
V 1	486.29	449.53	486.73	483.86	476.23	BETA(PR) 2	33.437	35.999	38.291	42.178	46.604		
VZ 0	392.12	392.12	392.12	392.12	392.12	V 1	486.29	490.53	486.73	483.86	476.23		
VZ 1	434.79	436.13	432.47	431.06	423.43	V 2	682.60	691.26	698.14	687.63	676.46		
V-THETA J	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	434.79	436.13	432.47	431.06	423.43		
V-THETA 1	217.81	224.52	223.32	219.79	217.93	VZ 2	399.86	435.09	444.48	420.27	378.74		
M J	0.3556	0.3556	0.3556	0.3556	0.3556	V-THETA 1	217.81	224.52	223.32	219.79	217.93		
M 1	0.4441	0.4481	0.4445	0.4418	0.4346	V-THETA 2	553.22	537.16	538.37	544.25	560.49		
TURN	-26.61	-27.24	-27.31	-27.32	-27.23	V(PR) 1	741.2	767.1	797.4	831.5	861.7		
UBAR	0.0959	0.0439	0.0455	0.0276	0.0415	V(PR) 2	479.2	537.8	566.3	567.1	551.3		
DFAC	0.016	0.035	0.044	0.050	0.070	VTHETA PR1	-60.0	-631.1	-669.9	-711.0	-750.4		
EFFP	0.8682	0.9444	0.9396	0.9664	0.9388	VTHETA PR2	-264.0	-316.1	-350.9	-380.8	-400.6		
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	818.03	855.62	893.22	930.78	968.37		
DEV	6.031	5.511	6.449	8.664	10.876	U 2	817.26	853.26	889.27	925.04	961.05		
						M 1	0.4441	0.4481	0.4445	0.4418	0.4346		
						M 2	0.5998	0.6138	0.6213	0.6090	0.5947		
						M(PR) 1	0.6769	0.7009	0.7282	0.7592	0.7863		
						M(PR) 2	0.4211	0.4775	0.5040	0.5023	0.4846		
						TURN(PR)	20.644	19.354	18.864	16.594	13.963		
						UBAR	0.0953	0.0229	0.0270	0.0977	0.1687		
						DFAC	0.5342	0.4704	0.4646	0.4991	0.5533		
						EFFP	0.7073	0.8924	0.9669	0.8925	0.8054		
						EFF	0.6960	0.8880	0.9655	0.8879	0.7970		
						INCID	2.39	1.74	2.17	3.26	4.45		
						DEV	10.997	7.099	4.451	4.038	4.614		
						LOSS PARA	0.03181	0.0078	0.0092	0.0326	0.0541		
STATION 2 - STATION 2A		STATION 0 - STATION 1					STATION 1 - STATION 2					SLOTTED ROTOR 1	
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10	
BETA 2	54.141	50.993	50.457	52.325	55.952	DEV	10.997	7.099	4.451	4.038	4.614		
BETA 2A	29.868	28.471	28.287	29.971	32.114	LOSS PARA	0.03181	0.0078	0.0092	0.0326	0.0541		
V 2	406.04	411.38	464.13	476.92	458.56								
VZ 2	399.86	435.09	444.48	420.27	378.74								
VZ 2A	352.11	361.63	458.71	413.14	388.40								
V-THETA 2	553.22	537.16	538.37	544.25	560.49								
V-THETA 2A	202.21	196.11	219.95	238.25	243.78								
M 2	6.5998	0.6138	0.6213	0.6090	0.5947								
M 2A	0.3519	0.3578	0.4053	0.4160	0.3981								
TURN	24.273	22.522	22.170	22.354	23.838								
UBAR	0.1587	0.2123	0.1539	0.1236	0.1772								
DFAC	0.4052	0.4049	0.3352	0.3064	0.3221								
EFFP	1.2695	0.8058	0.8394	0.9713	1.0372								
INCID	7.19	4.04	3.51	5.38	9.00								
DEV	12.93	11.53	11.35	13.33	15.17								
DIA	33.564	34.992	36.420	37.848	39.276								

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 100.49
Corrected Weight Flow = 95.25
Corrected Rotor Speed = 5615.50

INLET GUIDE VANE 1		STATION 0 - STATION 1						STATION 1 - STATION 2						SLOTTED ROTOR 1				
	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501							
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	26.750	27.500	27.750	27.500	27.500							
BETA 1	26.750	27.500	27.750	27.500	26.000	BETA 2	47.484	47.133	46.909	48.598	51.100							
V C	414.11	414.11	414.11	414.11	414.11	BETA(PR) 1	52.102	53.516	55.359	57.100	59.138							
V 1	515.76	518.72	515.02	511.43	502.06	BETA(PR) 2	33.136	36.460	38.286	42.206	47.052							
VZ 0	414.11	414.11	414.11	414.11	414.11	V 1	515.76	518.72	515.02	511.43	502.06							
VZ 1	466.56	460.11	455.79	453.64	451.25	V 2	698.51	695.39	705.34	690.17	666.17							
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	460.56	460.11	455.79	453.64	451.25							
V-THETA 1	232.14	239.52	239.80	236.15	220.09	VZ 2	472.05	473.07	481.86	456.44	418.33							
M 0	0.3761	0.3761	0.3761	0.3761	0.3761	V-THETA 1	232.14	239.52	239.80	236.15	225.09							
M 1	0.4722	0.4750	0.4715	0.4681	0.4591	V-THETA 2	514.86	509.67	515.09	517.69	518.44							
TURN	-26.75	-27.50	-27.50	-26.75	-26.75	V(PR) 1	749.8	773.8	801.8	835.2	879.7							
URAR	0.0922	0.0432	0.0373	0.0307	0.0263	V(PR) 2	563.7	588.2	613.9	616.2	614.0							
DFAC	0.0118	0.0336	0.0477	0.054	0.060	VTHETA PR1	-591.7	-622.2	-659.7	-701.2	-755.1							
EFFP	0.8753	0.9450	0.9518	0.9604	0.9122	VTHETA PR2	-308.1	-349.5	-380.3	-414.0	-449.4							
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	823.81	861.67	899.50	937.36	975.21							
DEV	5.890	5.250	6.010	8.180	12.110	M 1	0.4722	0.4750	0.4715	0.4681	0.4591							
STATOR 1		STATION 2 - STATION 2A						STATION 2 - STATION 2A						STATOR 1				
PCT SPAN	90	70	50	30	10	M 2	0.6240	0.6231	0.6331	0.6185	0.5916							
BETA 2	47.484	47.133	46.509	48.598	51.100	M(PR) 1	0.6865	0.7086	0.7341	0.8044	0.8785							
BETA 2A	28.683	28.041	27.086	29.645	32.834	M(PR) 2	0.5036	0.5271	0.5510	0.5522	0.5453							
V 2	698.51	695.39	705.34	690.17	666.17	TURN(PR)	18.967	17.055	17.074	14.893	12.086							
V 2A	409.20	451.48	464.36	459.63	450.20	UUBAR	0.0032	0.0065	0.0119	0.0749	0.1540							
VZ 2	472.05	473.07	481.86	456.44	418.33	DFAC	0.3989	0.3871	0.3868	0.4194	0.4677							
VZ 2A	358.99	398.48	413.43	399.46	378.28	EFFP	0.8928	0.9691	1.0404	1.0301	0.8739							
V-THETA 2	514.86	509.67	515.09	517.69	518.44	EFF	0.8889	0.9680	1.0419	1.0312	0.8739							
V-THETA 2A	196.40	212.24	211.44	227.34	244.10	INCID	0.41	-0.09	0.38	1.59	3.02							
M 2	0.6240	0.6231	0.6331	0.6185	0.5916	DEV	10.696	7.560	4.446	4.066	5.062							
M 2A	0.3556	0.3958	0.4074	0.4021	0.3926	LOSS PARA	0.001	0.0021	0.0041	0.0250	0.0490							
TURN	18.801	19.092	19.823	18.953	18.266													
UUBAR	0.1777	0.1048	0.1330	0.1347	0.1409													
DFAC	0.4142	0.3508	0.3416	0.3340	0.3242													
EFFP	0.6879	0.8419	0.7692	0.6885	0.7930													
INCID	0.53	0.18	-0.04	4.15	1.65													
DEV	11.74	11.10	10.15	12.71	15.89													
DIA	33.564	34.992	36.420	37.848	39.276													

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 99.87
 Corrected Weight Flow = 96.88
 Corrected Rotor Speed = 5580.70

INLET GUIDE VANE 1		STATION 0 - STATION 1				STATION 1 - STATION 2				SLOTTED ROTOR 1			
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN
DIA 0	33.622	35.167	36.711	38.256	39.801	DIA 2	33.589	35.067	36.545	38.023	39.501		
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	26.930	27.716	28.025	27.432	27.411		
BETA 1	26.930	27.716	28.025	27.432	27.411	BETA 2	45.886	45.406	45.199	45.912	48.523		
V 0	422.41	422.41	422.41	422.41	422.41	BETA(PR) 1	49.269	51.480	53.382	55.109	57.220		
V 1	550.10	542.94	539.26	537.41	527.03	BETA(PR) 2	32.994	35.048	37.742	41.478	46.193		
VZ 0	422.41	422.41	422.41	422.41	422.41	V 1	550.10	542.94	539.26	537.41	527.03		
VZ 1	490.44	480.65	476.03	476.98	467.96	V 2	699.13	708.88	709.07	694.40	668.09		
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	490.44	480.65	476.03	476.98	467.86		
V-THETA 1	249.14	252.52	253.38	247.58	242.63	VZ 2	486.66	497.69	499.65	483.13	442.49		
M 0	0.3839	0.3839	0.3839	0.3839	0.3839	V-THETA 1	249.14	252.52	253.38	247.58	242.63		
M 1	0.5052	0.4983	0.4947	0.4930	0.4830	V-THETA 2	501.94	504.79	503.13	498.76	500.55		
TURN	-26.93	-27.72	-28.03	-27.43	-27.41	V(PRI) 1	751.6	771.8	798.1	833.9	864.2		
UUBAR	0.0246	0.0429	0.0338	0.0177	0.0507	V(PRI) 2	580.2	607.9	631.8	644.9	639.2		
DFAC	-0.030	0.013	0.024	0.025	0.047	VTHETA PR1	-569.6	-603.8	-640.6	-684.0	-726.5		
EFFP	0.9772	0.9517	0.9623	0.9916	0.9326	VTHETA PR2	-316.0	-349.1	-386.8	-427.1	-461.3		
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	818.71	856.33	893.93	931.55	969.17		
INCIDS	0.000	0.000	0.000	0.000	0.000	U 2	817.91	853.90	889.89	925.88	961.87		
DEV	5.710	5.034	5.735	8.248	10.699	M 1	0.5052	0.4983	0.4947	0.4930	0.4830		
STATOR 1		M 2	0.6273	0.6385	0.6391	0.6244	0.5966						
STATOR 2 - STATION 2A		M(PR) 1	0.6903	0.7083	0.7322	0.7919	0.7919						
STATION 2 - STATION 2A		M(PR) 2	0.5206	0.5475	0.5695	0.5799	0.5799						
STATION 2 - STATION 2A		UUBAR	0.0439	0.0260	0.0310	0.1313	0.1313						
STATION 2 - STATION 2A		DFAC	0.3625	0.3503	0.3475	0.3676	0.3676						
STATION 2 - STATION 2A		EFFP	0.8346	0.9660	1.0145	0.9768	0.9768						
STATION 2 - STATION 2A		INCID	-2.42	-2.13	-1.60	-0.40	1.1.027						
STATION 2 - STATION 2A		DEV	10.554	6.148	3.902	3.338	4.203						
STATION 2 - STATION 2A		LOSS PARA	0.0164	0.0089	0.0107	0.0269	0.0269						
STATION 2 - STATION 2A		BETA 2	45.886	45.406	45.199	45.912	48.523						
STATION 2 - STATION 2A		BETA 2A	28.472	27.582	25.884	28.764	33.237						
STATION 2 - STATION 2A		V 2	699.13	708.88	709.07	694.40	668.09						
STATION 2 - STATION 2A		V 2A	417.36	463.36	474.21	468.94	460.43						
STATION 2 - STATION 2A		VZ 2	486.66	497.69	499.65	483.13	442.49						
STATION 2 - STATION 2A		VZ 2A	366.88	410.70	426.64	411.08	385.11						
STATION 2 - STATION 2A		V-THETA 2	501.94	504.79	503.13	498.76	500.55						
STATION 2 - STATION 2A		V-THETA 2A	198.97	214.54	207.02	225.66	252.37						
STATION 2 - STATION 2A		M 2	0.6273	0.6385	0.6391	0.6244	0.5966						
STATION 2 - STATION 2A		M 2A	0.3645	0.4086	0.4184	0.4128	0.4043						
STATION 2 - STATION 2A		TURN	17.414	17.824	19.315	17.148	15.286						
STATION 2 - STATION 2A		UUBAR	0.1780	0.1336	0.1344	0.1364	0.1350						
STATION 2 - STATION 2A		DFAC	0.4030	0.3463	0.3312	0.3247	0.3108						
STATION 2 - STATION 2A		EFFP	0.6895	0.8528	0.8151	0.7646	0.8439						
STATION 2 - STATION 2A		INCID	-1.06	-1.54	-1.75	-1.04	1.57						
STATION 2 - STATION 2A		DEV	11.53	1C.64	8.94	11.82	16.30						
STATION 2 - STATION 2A		DIA	33.564	34.992	36.420	37.848	39.276						

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 99.79
Corrected Weight Flow = 1.02.39
Corrected Rotor Speed = 5576.10

	INLET	GUIDE	VANE	1	STATION 0 - STATION 1				STATION 1 - STATION 2				STATION 1 - STATION 2				SLOTTED ROTOR 1							
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	
DIA	32.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501													
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	27.267	27.721	28.148	27.693	27.195													
BETA 1	27.267	27.721	28.148	27.693	27.195	BETA 2	42.717	41.738	41.264	41.689	43.074													
V 0	451.22	451.22	451.22	451.22	451.22	BETA(PR) 1	47.576	49.109	51.203	53.043	55.331													
V 1	571.75	575.24	569.45	567.00	555.56	BETA(PR) 2	31.090	34.944	38.347	41.607	45.878													
VZ 0	451.22	451.22	451.22	451.22	451.22	V 1	571.75	575.24	569.45	567.00	555.56													
VZ 1	508.22	509.22	502.11	502.05	494.15	V 2	728.76	718.70	708.96	696.48	669.19													
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	508.22	509.22	502.11	502.05	494.15													
V-THETA 1	261.94	267.58	268.64	263.50	253.90	VZ 2	535.43	536.29	532.91	520.11	488.83													
M 0	0.4109	0.4109	0.4109	0.4109	0.4109	V-THETA 1	261.94	267.58	268.64	263.50	253.90													
M 1	0.5261	0.5255	0.5239	0.5215	0.5105	V-THETA 2	494.37	478.46	467.58	463.22	457.02													
TURN	-27.27	-27.72	-28.15	-27.69	-27.20	V(PR) 1	753.3	777.9	801.4	835.1	868.7													
UUBAR	0.1073	0.0521	0.0502	0.0316	0.0670	V(PR) 2	625.2	654.2	679.5	695.6	702.2													
DFAC	0.001	0.021	0.036	0.039	0.057	VTHETA PR1	-556.1	-588.0	-624.6	-667.3	-714.5													
EFFP	0.8674	0.9371	0.9364	0.9614	0.9028	VTHETA PR2	-322.9	-374.7	-421.6	-461.9	-504.1													
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	818.03	855.62	893.19	930.78	968.37													
DEV	5.373	5.029	5.612	7.987	10.915	M 1	817.23	853.19	889.15	925.11	961.07													
						M 2	0.5261	0.5295	0.5239	0.5215	0.5105													
						M(PRI) 1	0.6609	0.6517	0.6443	0.6307	0.6018													
						M(PRI) 2	0.6933	0.7161	0.7373	0.7681	0.7982													
						TURN(PR)	16.486	14.165	12.856	11.436	9.453													
						UUBAR	0.0281	0.0174	0.0069	0.0470	0.0941													
						DFAC	0.2935	0.2737	0.2632	0.2800	0.3080													
						EFFP	0.9675	0.9666	1.0874	0.9907	0.8543													
						EFF	0.9666	0.9657	1.0899	0.9904	0.8504													
						INCID	-4.11	-4.50	-3.78	-2.47	-0.79													
						STATION 2 - STATION 2A																		
						PCT SPAN	90	70	50	30	10													
BETA 2	42.717	41.738	41.264	41.689	43.074	DEV	8.650	6.044	4.507	3.467	3.888													
BETA 2A	28.000	26.000	24.000	25.500	32.000	DFAC	0.2935	0.2737	0.2632	0.2800	0.3080													
V 2	483.47	492.02	499.04	495.53	474.68	EFFP	0.9675	0.9666	1.0874	0.9907	0.8543													
VZ 2	535.43	536.29	532.91	520.11	488.83	EFF	0.9666	0.9657	1.0899	0.9904	0.8504													
VZ 2A	426.88	442.23	455.50	447.26	402.55	INCID	-4.11	-4.50	-3.78	-2.47	-0.79													
V-THETA 2	494.37	478.46	467.58	463.22	457.02																			
V-THETA 2A	226.97	215.69	202.98	213.33	251.54																			
M 2	0.6609	0.6517	0.6443	0.6307	0.6018																			
M 2A	0.4250	0.4371	0.4439	0.4399	0.4197																			
TURN	14.717	15.738	17.264	16.189	11.074																			
UUBAR	0.1742	0.1469	0.1259	0.1401	0.1259																			
DFAC	0.3366	0.3154	0.2961	0.2885	0.2907																			
EFFP	0.5677	0.8220	C.7506	0.7544	0.7818																			
INCID	-4.23	-5.21	-5.69	-5.26	-3.88																			
DEV	11.06	9.06	7.06	8.56	15.06																			
DIA	33.564	34.992	36.420	37.848	39.276																			

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 99.70
Corrected Weight Flow = 103.78
Corrected Rotor Speed = 5571.30

INLET GUINE VANE 1		STATION 0 - STATION 1										STATION 1 - STATION 2										SLOTTED ROTOR 1	
PCT SPAN		90	70	50	30	10	PCT SPAN		90	70	50	30	10	PCT SPAN		90	70	50	30	10	PCT SPAN		
DIA 0	33.627	35.167	36.711	38.256	39.801	DIA 2	33.589	35.067	36.545	38.023	39.501												
BETA 0	0.300	0.010	0.000	0.000	0.000	BETA 1	27.195	27.780	28.460	27.813	26.869												
BETA 1	27.195	27.780	28.460	27.813	26.869	BETA 2	37.899	37.647	37.130	37.617	38.165												
V 0	458.67	458.67	458.67	458.67	458.67	BETA(PR) 1	46.323	47.615	49.562	51.596	53.856												
V 1	588.62	595.53	591.74	587.72	578.24	RFTA(PR) 2	31.386	36.184	38.471	41.973	46.755												
V2 0	458.67	458.67	458.67	458.67	458.67	V 1	588.62	595.53	591.74	587.72	578.24												
V2 1	523.55	526.89	520.23	519.82	515.81	V 2	745.67	716.38	718.10	698.69	660.48												
V-THETA 0	-C.00	-0.00	-0.00	-0.00	-0.00	VZ 1	523.55	526.89	520.23	519.82	515.81												
V-THETA 1	269.01	277.56	281.99	274.22	261.33	VZ 2	589.13	567.22	572.52	553.44	519.29												
M 0	0.4179	0.4179	0.4179	0.4179	0.4179	V-THETA 1	269.01	277.56	281.99	274.22	261.33												
M 1	0.5453	0.5453	0.5456	0.5457	0.5325	V-THETA 2	457.12	437.56	433.46	426.47	408.13												
TURN	-27.20	-27.78	-28.46	-27.81	-26.87	V(PRI) 1	758.1	781.6	802.0	836.8	874.5												
UUBAR	0.1304	0.C511	0.0415	0.0258	0.0529	V(PRI) 2	690.1	702.8	731.3	744.4	758.0												
DFAC	-0.013	C.0554	C.018	0.021	0.031	VTHETA PR1	-548.3	-577.3	-610.4	655.8	-796.2												
EFFP	0.8504	0.9435	0.9536	0.9726	0.9324	VTHETA PR2	-359.4	-414.9	-454.9	-497.8	-552.1												
INCID	C.0000	C.0000	C.0000	C.0000	C.0000	U 1	817.33	854.89	892.42	929.98	967.54												
DEV	5.445	4.970	5.300	7.867	11.241	U 2	816.53	852.46	888.39	924.32	960.25												
STATION 1		M 1	M 2	M 3	M 4	M 5	M 1	M 2	M 3	M 4	M 5												
STATION 2 - STATION 2A		M(PRI) 1	M(PRI) 2	M(PRI) 3	M(PRI) 4	M(PRI) 5	M(PRI) 1	M(PRI) 2	M(PRI) 3	M(PRI) 4	M(PRI) 5												
STATION 2		TURN(PR)	UUBAR	DFAC	EFFP	EFF	INCID	TURN(PR)	UUBAR	DFAC	EFFP	EFF	INCID	TURN(PR)	UUBAR	DFAC	EFFP	EFF	INCID	TURN(PR)	UUBAR	DFAC	EFFP
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10
BETA 2	37.809	37.647	37.130	37.617	38.165	BETA 2A	37.617	38.165	38.646	39.134	39.501												
BETA 2A	26.491	24.505	23.386	26.103	29.874	V 2	745.67	716.38	718.10	698.59	660.48												
V 2A	563.55	552.09	551.17	548.06	519.68	V 2	589.13	567.22	572.52	553.44	529.29												
V 2A	589.13	567.22	572.52	553.44	529.29	V 2A	504.38	502.36	505.89	492.16	450.63												
V 2A	504.38	502.36	505.89	492.16	450.63	V-THETA 2	457.12	437.56	433.46	426.47	408.13												
V-THETA 2A	251.37	228.99	218.77	241.14	258.95	V-THETA 2A	251.37	228.99	218.77	241.14	258.95												
M 2	0.6816	0.6533	0.6569	0.6371	0.5989	M 2A	0.5018	0.4961	0.4957	0.4924	0.4649												
M 2A	0.5018	0.4961	0.4957	0.4924	0.4649	TURN	11.318	13.142	13.744	11.514	8.291												
TURN	0.1936	0.1376	0.1599	0.1346	0.1429	UUBAR	0.2442	0.2293	0.2325	0.2156	0.2132												
DFAC	0.4688	0.4688	0.4764	0.6764	0.6687	DFAC	-9.14	-9.30	-9.33	-8.82	-8.74												
EFFP	9.55	7.57	6.45	9.16	12.93	EFFP	34.992	36.420	37.848	39.276													
INCID	33.564					INCID																	

Table B-2. Blade Element Performance (Continued)

Percent Design Speed	=	109.28
Corrected Weight Flow	=	99.49
Corrected Rotor Speed	=	6106.78

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 110.28
Corrected Weight Flow = 103.66
Corrected Rotor Speed = 6162.67

INLET GUIDE VANE 1										SLOTTED ROTOR 1										
STATION 0 - STATION 1					STATION 1 - STATION 2					STATION 1 - STATION 2					STATION 1 - STATION 2					
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	PCT SPAN	90	70	50	30	10				
DIA	33.622	35.167	36.711	38.250	39.801	DIA	33.589	35.067	36.545	38.023	DIA	33.589	35.067	36.545	38.023	39.501				
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	26.779	27.354	27.576	26.956	BETA 2	47.689	46.861	46.605	48.521	27.092				
BETA 1	26.779	27.354	27.576	26.956	27.092	BETA 3	50.364	52.084	54.111	48.521	BETA (PR)	1	50.364	52.084	54.111	50.376				
V 0	458.04	458.04	458.04	458.04	458.04	V 1	33.047	36.132	39.200	42.511	BETA (PR)	2	33.047	36.132	39.200	42.511	58.532			
V 1	591.55	591.12	584.82	577.66	560.32	V 2	591.56	591.12	584.82	577.66	BETA (PR)	3	591.56	591.12	584.82	577.66	46.401			
VZ 0	458.04	458.04	458.04	458.04	458.04	VZ 1	767.09	767.31	763.57	753.80	VZ 2	528.11	525.02	518.39	514.90	737.63				
VZ 1	528.11	525.02	518.39	514.90	498.84	VZ 3	516.37	524.66	524.59	499.28	VZ 4	516.37	524.66	524.59	499.28	498.84				
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	V-THETA 1	266.53	270.73	261.86	270.73	V-THETA 2	1	266.53	270.73	261.86	270.73	470.42			
V-THETA 1	266.53	271.61	270.73	261.86	255.18	V-THETA 3	0.4173	0.4173	0.4173	0.4173	V-THETA 4	2	567.27	559.90	554.84	564.75	255.18			
M 0	0.4173	0.4173	0.4173	0.4173	0.4173	M 1	0.5319	0.5319	0.5319	0.5319	M 2	827.9	854.4	884.3	923.7	955.6				
M 1	0.5454	0.5450	0.5389	0.5319	0.5151	M 3	616.0	649.6	676.9	677.3	M 4	-637.6	-674.0	-716.4	-766.8	682.2				
TURN	-26.78	-27.35	-27.58	-26.96	-27.09	V(PRI) 1	0.0217	0.0229	0.0280	0.0280	V(PRI) 2	904.09	945.63	987.15	1028.69	-815.1				
UBAR	0.0597	0.0211	0.0211	0.0217	0.0229	V(PRI) 3	0.0062	0.0062	0.0062	0.0062	V(PRI) 4	-335.9	-383.0	-427.8	-457.7	-494.0				
DFAC	-0.023	0.006	0.019	0.019	0.019	VTHETA PR1	0.9746	0.9746	0.8690	0.8690	VTHETA PR2	903.20	942.94	982.69	1022.43	1062.17				
EFFP	0.9318	0.9798	0.9798	0.9798	0.9798	U 1	0.0000	0.0000	0.0000	0.0000	U 2	0.5454	0.5450	0.5389	0.5319	0.5151				
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	M 1	0.6850	0.6890	0.6869	0.6749	M 2	0.7633	0.7877	0.8148	0.8505	0.6555				
DEV	5.861	5.396	6.184	8.724	11.018	M 3	0.5501	0.5841	0.6090	0.6064	M 4	17.317	15.952	14.911	13.609	12.131				
STATOR 1										STATION 2 - STATION 2A										
PCT SPAN	90	70	50	30	10	DFAC	0.4011	0.3820	0.3773	0.4197	EFFP	0.8291	0.9849	1.0311	0.9594	0.8895				
BFTA 2	47.689	46.861	46.605	48.521	50.376	TURN(PR)	-1.33	0.8222	0.9842	1.0324	0.9577	UBAR	0.0406	0.0223	0.0270	0.1054	0.1377			
BETA 2A	29.000	28.500	28.000	29.000	33.000	DFV	10.607	7.232	5.360	4.371	LOSS PARA	0.0136	0.0075	0.0091	0.0350	0.0443				
V 2	767.09	767.31	763.57	753.80	737.63	INCID	-1.53	-1.53	-1.53	-0.87	INCID	0.4011	0.3820	0.3773	0.4197	0.4463				
V 2A	305.31	373.08	383.43	391.99	371.91	EFF	0.8291	0.9849	1.0311	0.9594	EFF	0.5501	0.5841	0.6090	0.6064	0.6062				
VZ 2	516.37	524.66	524.59	499.28	470.42	TURN	18.361	18.605	19.521	17.376	TURN	17.317	15.952	14.911	13.609	12.131				
VZ 2A	267.03	327.87	338.55	342.85	311.91	UBAR	0.0406	0.0223	0.0270	0.1054	UBAR	0.0406	0.0223	0.0270	0.1054	0.1377				
V-THETA 2	567.27	559.90	554.84	564.75	568.16	DFV	0.4011	0.3820	0.3773	0.4197	LOSS PARA	0.0136	0.0075	0.0091	0.0350	0.0443				
V-THETA 2A	148.02	178.02	180.01	190.04	202.56	INCID	-1.53	-1.53	-1.53	-0.87	INCID	0.4011	0.3820	0.3773	0.4197	0.4463				
M 2	0.6850	0.6900	0.6869	0.6749	0.6555	EFF	0.8291	0.9849	1.0311	0.9594	EFF	0.5501	0.5841	0.6090	0.6064	0.6062				
M 2A	0.2619	0.3240	0.3332	0.3396	0.3210	TURN	18.689	18.361	18.605	19.521	TURN	17.317	15.952	14.911	13.609	12.131				
TURN	18.689	18.361	18.605	19.521	17.376	UBAR	0.0406	0.0223	0.0270	0.1054	UBAR	0.0406	0.0223	0.0270	0.1054	0.1377				
UBAR	0.3811	0.3308	0.3378	0.3385	0.3866	DFAC	0.4011	0.3820	0.3773	0.4197	DFAC	0.5501	0.5841	0.6090	0.6064	0.6062				
DFAC	0.6020	0.5138	0.4979	0.4800	0.4958	EFFP	0.8291	0.9849	1.0311	0.9594	EFFP	0.5501	0.5841	0.6090	0.6064	0.6062				
EFFP	0.5628	0.6223	0.5916	0.5765	0.5631	INCID	0.74	-0.34	1.57	3.43	INCID	0.74	-0.34	1.57	3.43	4.411				
INCID	0.74	-0.09	-0.34	1.57	3.43	DEV	12.06	11.56	11.06	12.06	DEV	12.06	11.56	11.06	12.06	12.06				
DIA	33.564	34.992	36.420	37.848	39.276	DIA	33.564	34.992	36.420	37.848	DIA	33.564	34.992	36.420	37.848	39.276				

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Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 109.89
 Corrected Weight Flow = 107.61
 Corrected Rotor Speed = 6140.72

INLET GUIDE VANE 1										SLOTTED ROTOR 1										
STATION 0 - STATION 1					STATION 1 - STATION 2					STATION 0 - STATION 1					STATION 1 - STATION 2					
PCT	SPAN	90	70	50	30	10	PCT	SPAN	90	70	50	30	10	PCT	SPAN	90	70	50	30	10
DIA	33.622	35.167	36.711	38.256	39.801	39.801	DIA	33.589	35.067	36.545	38.023	39.501								
BETA 0	0.000	0.000	0.000	0.000	0.000	0.000	BETA 1	27.040	24.578	26.941	27.151	26.790								
BETA 1	27.040	24.578	26.941	27.151	26.790	26.790	BETA 2	44.271	43.134	42.891	43.137	42.891								
V 0	479.55	479.55	479.55	479.55	479.55	479.55	BETA(PR) 1	48.230	50.485	52.150	54.066	54.066								
V 1	620.50	620.52	614.67	608.69	591.99	591.99	BETA(PR) 2	33.048	36.211	39.083	42.327	46.760								
V 2 0	479.55	479.55	479.55	479.55	479.55	479.55	V 1	620.50	620.52	614.67	608.69	591.99								
V 2 1	552.67	564.30	547.96	541.61	528.45	528.45	V 2	773.23	771.40	767.60	755.57	725.58								
V-T-HETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	552.67	564.30	547.96	541.61	528.45								
V-T-HETA 1	282.08	258.09	278.49	277.77	266.82	277.77	VZ 2	553.67	562.93	562.38	551.36	509.37								
M 0	0.4377	0.4377	0.4377	0.4377	0.4377	0.4377	V-T-HETA 1	282.08	258.09	278.49	277.77	266.82								
M 1	0.5738	0.5739	0.5681	0.5622	0.5459	0.5459	V-T-HETA 2	539.76	527.41	522.43	516.62	516.73								
TURN	-27.04	-24.58	-26.94	-27.15	-26.79	-26.79	V(PR) 1	829.7	886.9	893.0	922.9	958.4								
UUBAR	0.0545	0.0193	0.0199	0.0210	0.0210	0.0210	V(PR) 2	660.5	697.7	724.5	745.8	743.5								
DFAC	-0.017	-0.025	0.009	0.024	0.024	0.024	VTHETA PR1	-618.8	-684.2	-705.1	-747.3	-799.6								
EFFP	0.9382	0.9818	0.9802	0.9776	0.9850	0.9850	VTHETA PR2	-360.2	-412.2	-456.8	-502.2	-541.7								
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	900.87	942.26	983.63	1025.03	1066.43								
DEFV	5.600	8.172	6.819	8.529	11.320	11.320	U 2	899.98	939.58	979.19	1018.79	1058.39								
STATOR 1										M 1	0.5738	0.5739	0.5622	0.5459						
STATOR 2 - STATION 2A										M 2	0.7004	0.7004	0.6972	0.6515						
PCT	SPAN	90	70	50	30	10	M(PR) 1	0.7673	0.8202	0.8254	0.8838									
BETA 2	44.271	43.134	42.891	43.137	45.411	45.411	M(PR) 2	0.5983	0.6332	0.6581	0.6760	0.6676								
BETA 2A	28.600	27.500	25.500	27.000	32.600	32.600	TURN(PR)	15.182	14.273	13.067	11.739	9.780								
V 2	773.23	771.40	767.60	755.57	725.58	725.58	UUBAR	0.0611	0.1084	0.0501	0.0587	0.1223								
V 2A	465.67	507.87	514.09	519.81	505.21	505.21	DFAC	0.3281	0.3416	0.3106	0.3138	0.3531								
VZ 2	553.67	562.93	562.38	551.36	509.37	509.37	DEV	1.0027	1.0742	1.0683	0.8969	0.8969								
VZ 2A	408.85	450.49	464.01	463.16	425.61	425.61	EFF	0.9259	1.0028	1.0742	1.0683	0.8969								
V-T-HETA 2	539.76	527.41	522.43	516.62	516.73	516.73	INCID	-3.46	-3.13	-2.83	-1.44	0.42								
V-T-HETA 2A	222.91	234.51	221.32	235.99	272.19	272.19	LOSS PARA	0.0205	0.0366	0.0169	0.0196	0.0392								
M 2	0.7004	0.7001	0.6972	0.6849	0.6515	0.6515	DEV	10.608	7.311	5.243	4.187	4.770								
M 2A	0.4054	0.4481	0.4542	0.4583	0.4437	0.4437	LOSS PARA	0.0205	0.0366	0.0169	0.0196	0.0392								
TURN	15.671	15.634	17.391	16.137	12.811	12.811														
UUBAR	0.2140	0.1532	0.1600	0.1543	0.1501	0.1501														
DFAC	0.3978	0.3416	0.3303	0.3120	0.3037	0.3037														
EFFP	0.5501	0.7373	0.7121	0.6555	0.7224	0.7224														
INCID	-2.68	-3.82	-4.06	-3.81	-1.54	-1.54														
DEV	11.66	10.56	8.56	10.06	15.66	15.66	DIA	36.420	34.992	37.848	39.276	39.276								

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 109.44
Corrected Weight Flow = 108.82
Corrected Rotor Speed = 6115.65

INLET GUIDE VANE		STATION 0 - STATION 1			STATION 1 - STATION 2			STATION 1 - ROTOR 1					
PCT SPAN		90	70	50	30	10	PCT SPAN	90	70	50	30	10	
DIA	33.622	35.167	36.711	38.256	39.801	DIA	33.589	35.067	36.545	38.023	39.501		
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	29.220	29.328	29.297	29.443	25.344		
BETA 1	29.230	29.328	29.297	29.443	25.344	BETA 2	41.248	40.222	39.892	39.861	42.230		
V 0	486.27	486.27	486.27	486.27	486.27	BETA(PR) 1	46.895	48.900	50.986	52.832	55.655		
V 1	631.51	630.15	625.66	622.40	606.67	BETA(PR) 2	31.915	35.283	39.164	41.998	46.536		
VZ 0	486.27	486.27	486.27	486.27	486.27	V 1	631.51	630.15	625.66	622.40	606.67		
VZ 1	551.10	549.38	545.64	542.01	548.28	V 2	794.90	788.97	770.11	761.72	725.26		
V-THETA 0	-0.00	-0.00	-0.00	-0.00	-0.00	VZ 1	551.10	549.38	545.64	542.01	548.28		
V-THETA 1	308.38	308.65	306.16	305.95	259.69	VZ 2	597.65	602.42	590.87	584.70	537.02		
M 0	0.4441	0.4441	0.4441	0.4441	0.4441	V-THETA 1	308.38	308.65	306.16	305.95	259.69		
M 1	0.5847	0.5834	0.5789	0.5757	0.5602	V-THETA 2	524.09	509.48	493.90	488.21	487.45		
TURN	-29.23	-29.33	-29.30	-29.44	-25.34	V(PRI) 1	806.5	835.7	866.8	897.1	971.3		
UUBAR	0.0796	0.0511	0.0425	0.0253	0.0812	V(PRI) 2	704.1	738.0	762.1	786.8	780.7		
DFAC	-0.000	0.021	0.029	0.039	0.026	VTHETA PR1	-588.8	-629.8	-673.5	-714.9	-802.4		
EFFP	0.9111	0.9428	0.9514	0.9727	0.8903	VTHETA PR2	-372.2	-426.3	-481.3	-526.4	-566.6		
INCID	0.0000	0.0000	0.0000	0.0000	0.0000	U 1	897.19	938.42	979.62	1020.84	1062.07		
DEV	3.410	3.422	4.463	6.237	12.766	U 2	896.31	935.75	975.19	1014.63	1054.07		
						M 1	0.5847	0.5834	0.5789	0.5757	0.5602		
						M 2	0.7254	0.7204	0.7031	0.6947	0.6554		
						M(PR) 1	0.7467	0.7737	0.8020	0.8278	0.8974		
						M(PR) 2	0.6425	0.6738	0.6957	0.7175	0.7055		
						TURN(PR)	14.980	13.617	11.822	10.834	9.119		
						UUBAR	0.0082	-0.0083	0.0018	0.0047	0.1710		
						DFAC	0.2341	0.2190	0.2183	0.2198	0.3131		
						EFFP	0.9455	0.9887	1.0269	1.0404	0.6544		
						EFF	0.9439	0.9884	1.0277	1.0416	0.8503		
						INCID	-4.80	-4.71	-3.99	-2.68	-0.47		
		STATION 2 - STATION 2A											
PCT SPAN		90	70	50	30	10							
BETA 2	41.248	40.222	39.892	39.861	42.230	DEV	9.475	6.383	5.324	3.858	4.546		
BETA 2A	28.200	26.500	25.000	25.500	31.000	LOSS PARA	0.0028	-0.0028	0.0006	0.0016	0.0549		
V 2	794.90	788.97	770.11	761.72	725.26								
V 2A	532.40	551.55	550.27	557.11	520.40								
VZ 2	597.65	602.42	590.87	584.70	537.02								
VZ 2A	469.20	493.60	498.71	502.84	446.07								
V-THETA 2	524.09	509.48	493.90	488.21	487.45								
V-THETA 2A	251.58	246.10	232.55	239.84	268.03								
M 2	0.7254	0.7204	0.7031	0.6947	0.6554								
M 2A	0.4669	0.4896	0.4890	0.4953	0.4602								
TURN	13.048	13.722	14.892	14.361	11.230								
UUBAR	0.2008	0.1635	0.1440	0.1405	0.1634								
DFAC	0.3302	0.3009	0.2855	0.2686	0.2825								
EFFP	0.5031	0.6725	0.6636	0.6467	0.6676								
INCID	-5.70	-6.73	-7.06	-7.09	-4.72								
DEV	11.26	9.56	8.06	8.56	14.06								
DIA	33.564	34.992	36.420	37.848	39.276								

Table B-2. Blade Element Performance (Continued)

Percent Design Speed = 110.15
Corrected Weight Flow = 109.75
Corrected Rotor Speed = 6155.38

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	STATION 0 - STATION 1				STATION 1 - STATION 2						
PCT SPAN	90	70	50	30	10	PCT SPAN	90	70	50	30	10
EIA	32.622	35.167	36.711	38.256	39.801	DIA	33.589	35.667	36.545	38.023	39.501
BETA 0	0.000	0.000	0.000	0.000	0.000	BETA 1	26.986	26.951	27.780	27.158	25.000
BETA 1	26.986	26.951	27.780	27.158	25.000	BETA 2	37.816	37.647	36.928	36.932	38.499
V 0	491.47	491.47	491.47	491.47	491.47	BETA(PR) 1	47.005	48.943	50.835	52.724	55.140
V 1	640.65	635.66	635.20	632.12	620.15	BETA(PR) 2	32.859	36.204	40.190	43.033	48.451
VZ 0	491.47	491.47	491.47	491.47	491.47	V 1	640.65	639.66	635.20	632.12	620.15
VZ 1	570.19	561.95	562.43	562.05	562.05	VZ 2	803.05	791.26	769.16	758.07	704.66
V-THETA 0	-C.CC	-0.00	-C.00	-0.00	-0.00	VZ 1	570.89	570.19	561.99	562.43	562.05
V-THETA 1	286.51	256.05	288.53	262.09	262.09	VZ 2	634.40	626.47	614.86	605.96	551.48
M 0	0.4490	0.4490	0.4490	0.4490	0.4490	V-THETA 1	290.71	289.91	296.05	288.53	262.09
M 1	0.5928	0.5928	0.5884	0.5735	0.5735	V-THETA 2	492.37	483.26	462.12	455.50	438.65
TURN	-26.59	-26.55	-27.78	-27.16	-25.00	V(PR) 1	837.2	868.1	889.9	928.6	983.3
UEEAR	C.CS11	C.CS69	C.0485	C.0279	0.0627	V(PR) 2	755.2	776.4	804.9	829.0	831.5
DFAC	-C.C25	-C.C07	0.COS	0.C11	0.012	VTHETA PR1	-612.3	-654.6	-689.9	-738.9	-806.9
EFFP	C.SCC2	C.9372	0.9452	0.9698	0.9196	VTHETA PR2	-409.8	-458.6	-519.4	-565.7	-622.3
INCID	C.CCCCC	C.C000	0.0000	0.0000	0.0000	U 1	903.02	944.51	985.98	1027.48	1068.97
CEV	5.654	5.799	5.980	8.522	13.110	U 2	902.13	941.83	981.52	1021.22	1066.91
						M 1	0.5938	0.5928	C.5884	0.5853	C.5735
						M 2	0.7357	0.7265	0.7056	0.6943	0.6390
						M(PR) 1	0.7759	C.8C45	C.8242	C.8599	0.9094
						M(PR) 2	0.6919	C.7129	C.7384	0.7592	0.7541
						TURN(PR)	14.146	12.739	10.646	9.691	6.589
						UUBAR	0.0781	0.0879	0.0621	0.0847	0.1367
						M(PR) 1	0.7759	C.8C45	C.8242	C.8599	0.9094
						M(PR) 2	0.6919	C.7129	C.7384	0.7592	0.7541
						TURN(PR)	14.146	12.739	10.646	9.691	6.589
						UUBAR	0.0781	0.0879	0.0621	0.0847	0.1367
						DFAC	0.1944	C.2C04	C.1935	0.2452	
						EFFP	C.8552	C.9559	0.9600	0.9453	0.6396
						EFF	C.8516	C.9549	0.9591	0.9441	0.6838
						INCID	-4.69	-4.67	-4.14	-2.79	-0.98
						PCT SPAN					
BETA 2	37.816	37.647	36.928	36.932	38.499	DEV	10.419	7.304	6.350	4.893	6.461
BETA 2A	27.6CC	26.0CC	24.500	25.000	30.000	LOSS PARA	0.0262	0.0297	0.0206	0.0279	0.0578
V 2	597.12	6C2.48	55C.C8	605.61	562.89						
VZ 2	624.40	626.47	614.86	605.96	551.48						
VZ 2A	525.17	541.51	536.95	548.86	487.48						
V-THETA 2	492.37	483.26	462.12	455.50	438.65						
V-THETA 2A	276.64	264.11	244.7C	255.94	281.45						
M 2	0.7357	0.7265	0.7056	0.6943	0.6390						
M 2A	0.5291	C.54C2	C.5285	0.5436	0.5022						
TURN	1C.216	11.647	12.428	11.932	8.499						
UEEAR	C.2CC7	C.1758	C.1705	C.1362	0.1316						
DFAC	0.2564	0.2385	0.2328	0.2011	0.2012						
EFFP	0.4571	C.5924	C.570C	0.5909	0.6147						
INCID	-9.12	-9.30	-10.02	-10.02	-8.45						
DEV	1C.66	9.06	7.56	8.06	13.06						
DIA	33.564	34.992	36.420	37.848	39.276						

APPENDIX C
REFERENCES

1. NASA CR-54544, PWA FR-1713, "Single Stage Experimental Evaluation of Slotted Rotor and Stator Blading, Part I Analysis and Design," July 1966.
2. NASA CR-54545, PWA FR-1669, "Single Stage Experimental Evaluation of Slotted Rotor and Stator Blading, Part II Annular Cascade Investigation of Slot Location and Geometry," September 1966.
3. Aerodynamic Design of Axial Flow Compressors (Revised), NASA SP-36, 1965, p 248.
4. Smith, L. H. Jr.; "Wake Dispersion in Turbomachines," Transactions of the ASME; Journal of Basic Engineering, September 1966, pp 688 through 690.